


PACIFIC DISCOVERY



**EARLY AMERICANS:
FROM THE ARCTIC
TO THE ANDES**

Editor and Art Director: DON GREAME KELLEY; Managing Editor: ROBERT C. MILLER; Associate Editors: IRA L. WIGGINS (Stanford University), A. STARKER LEOPOLD (University of California); VERONICA J. SEXTON, BENJAMIN DRAPER, ROBERT T. ORR, ALLYN G. SMITH (California Academy of Sciences); Special Correspondent: THANE RINEY (Wellington, New Zealand)
Advertising and Circulation Manager: GARY B. BARRETT

IN THE HISTORY of an institution such as the California Academy of Sciences, or of a part of one, such as this magazine, times come when those directing things must think of growth and improvement. Despite gratifying comments from many readers who seemed happy with *PD* just as it was, the truth has always been on the editorial mind that nothing is ever so good it cannot be made better. It does not take long, however, to find out that it is humanly impossible to make each one just a little better than the last — indefinitely! Eyes must therefore be cast over the long run to some attainable objective. As for getting there, it is like a multi-stage rocket. In order to keep it moving another charge must be fired off at the right moment. *PD* has never stopped accelerating, but we think the time has come to shoot for higher goals.

Our editorial following—"A New Pacific Discovery"—we hasten to assure our constant readers, does not foreshadow a completely different magazine. Just as the institution grows by means of periodic physical additions and internal reorganization to fulfill its destiny, so must its official voice, *Pacific Discovery*, reach out for wider audiences through timely changes of emphasis and increases of volume. Our recent look around the Pacific has confirmed the already expressed belief that wider audiences are waiting to be reached. Dedicated as it is to public service and enlightenment through science, the Academy in all its parts has an obligation to grow with the expanding times. People are moving Pacificward from both sides of the earth; the center of gravity is shifting. The Pacific world is discovering itself. For the present, then, we promise more "Pacific" in *Pacific Discovery*. We shall accelerate towards our long-established goal of increasing knowledge and understanding of nature and man in the Pacific World. Our plans will not materialize overnight. Evolution, not revolution, is to be the process of growth. More than ever, we shall feel the need of communication from as well as with our readers. Finally, our great need, as always, is for more readers; or, to put the shoe on the right foot, we must find more readers who need *Pacific Discovery*!

DID THE UNIVERSITY OF CALIFORNIA PRESS have a tip-off on the Alaska statehood vote? We're just asking. . . . Their *Landscapes of Alaska* happened to come out only a week or two before the news broke. Under the editorship of Dr. Howel Williams, University of California professor of geology, the book greatly enlarges our view of the vast chunk of land soon to be Number 49. The Introduction he wrote with John C. Reed is presented here almost entire, with the publisher's kind permission. . . . ¶The second of the "Eskimo Hunters" series, by Richard D. Taber of the Montana State University School of Forestry faculty, makes a pointed observation on why men shoot birds—Eskimo men, that is (any suggested resemblance to more southerly American males is purely a suggestion). . . . ¶Annette Richards Parent of Tucson, Arizona, again pleads for support of the program of the National Park Service, this time in behalf of the many and sadly run-down archeological national monuments in the Southwest. . . . ¶A combined faculty-student project of the California School of Fine Arts of San Francisco, under the auspices of the California Archeological Survey, has resulted in a most unusual pictorial presentation. On the faculty side, Jay C. von Werlhof (who studied anthropology at the University of California) wrote the story; the photographer, Pirkle Jones, also teaches his art. Three of the photos are by student participants. . . . ¶Philip Ferry recently paid an extended visit to South America—merely a chaser to the trip around the world he'd just tossed off. . . . ¶Morrison Planetarium lecturer Charles F. Hagar believes that if enough people ask a certain question, you get the answer into print—in *PD* of course. This saves a lot of correspondence; and besides, more people will have to buy *PD*—see? D.G.K.

Copyright 1958 by California Academy of Sciences

A JOURNAL OF NATURE AND MAN IN THE PACIFIC WORLD

IN THIS ISSUE

EDITORIAL

- A New Pacific Discovery 1
Introducing Alaska's Landscapes
JOHN C. REED & HOWEL WILLIAMS (from *Landscapes of Alaska*) 2

Eskimo Hunters:

2. The Bird Shooters
RICHARD D. TABER 7

CONSERVATION

- The Walls Come Tumbling Down
ANNETTE RICHARDS PARENT 10

- Granite Galleries
JAY C. VON WERLHOF 16

- Civilization in Stone
PHILIP FERRY 22

- ASTRONOMY: Charting the Sun's Daily Path Across the Sky
CHARLES F. HAGAR 28

- REVIEWS 30
Academically Speaking 32



THE COVER

UNTITLED, by Unknown California Artist. Indian painters were busy with brush and palette long before the "artists' colony" idea came into California with the promoter breed, as this Tulare County composition shows. Photo by Pirkle Jones (see pages 16-22).

Pacific Discovery is published bimonthly at Gillick Press by the California Academy of Sciences. Publication office: 2057 Center Street, Berkeley 4. Editorial, Advertising and Circulation offices: Golden Gate Park, San Francisco 18. Annual subscriptions: U.S., \$3; Foreign, \$3.50. Single copies, 50c. Members of the Academy subscribe through their dues. Entered as second-class matter, February 17, 1948, at the Post Office, Berkeley 4, California, under the act of August 24, 1912.

AIRBORNE between Auckland and Honolulu, homeward bound from his six-month spin around the rim of the Western Pacific, your editor might expectedly be looking back, like the bird in the fable, to see where he's been. At this moment of writing, however, and at other moments — during a between-planes pause in Fiji, and a visit to Honolulu's hospitable Bernice P. Bishop Museum — he would rather be looking ahead. Having discovered the Pacific, he has, in his mental wheelhouse, begun charting a new course for *Pacific Discovery*.

This 42,000-mile journey has had a twofold purpose, both sides directly concerned with *PD* and its future. It was the means to a personal discovery of the Pacific; and it was intended to lead off toward wider horizons for this Pacific journal.

Many readers have, during our ten years in print, asked a fair question: why was there not more of the Pacific in *Pacific Discovery*? The editors have readily admitted that there should be — we did have a name to live up to. The admission has naturally implied an obligation to do something about it. Almost a year and a half ago, an editorial proposal was submitted to the Academy's Trustees, as our publishers, for the expansion and promotion of this magazine in the direction of its obvious goal: the fulfillment of its rôle as a journal of nature and man in the Pacific World. With the blessing of Director, Council, and Trustees on his head, it remained only for the editor to start doing something — to "get cracking" as the Aussies say.

It seemed logical to all concerned that as a first step the editor should be launched into orbit around the Pacific, to get an "Explorer's" eye view of the part of the world he proposed to make more completely *PD*'s own. So it was that last October 31, powered by the funds of a Guggenheim Fellowship and others contributed generously through The San Francisco Foundation by several

of the Academy's most dedicated friends, *Pacific Discovery*'s editor took off to discover the Pacific.

How the editor discovered the Pacific and what he found there will provide some future articles (after film has been processed and data organized). The other side of the picture — that in which *PD*'s future begins to be outlined — is our present editorial subject. But since the projected design springs as much from recent discovery as from prior discussion, a quick glance back will provide a good starting point, taking off from our report in the March-April issue.

The months since Bangkok, Malaya, and Singapore have found the editor hunting fossil elephant teeth and prehistoric hand axes in Northern Luzon; chasing quokkas and crayfish by moon and torch light on Western Australia's Rottne Island; learning the literal meaning of "Nullarbor" from train windows crossing the earth's blankest, flattest landscape bordering the Great Australian Bight; stalking the lyre bird in Victoria's famous Sherbrooke Forest; sweating out rides on the desert track north from the town called Alice; inspecting Australia's copper wealth a thousand feet under Queensland's Mt. Isa, 200 feet below sea level; "shooting" half-wild bulls at pointblank lens range on a Commonwealth scientific cattle breeding station; revisiting Captain Cook's landing places on both sides of the Tasman Sea; sharing with our New Zealand correspondent the thrill of seeing (first time for him, too) North Island's magnificent East Cape coastline—these are among the adventure highlights.

In fields of science even this hurried look has been most rewarding in things seen, some in fair detail, others glimpsed in passing. During five weeks in the Philippines the editor witnessed and had a small hand in discoveries which have extended the human horizon far back in that part of the Pacific. He learned much about the wide-ranging and portentous scientific effort by which Australia is solving basic problems of land and resource development and conservation, for the incalculable benefit of the Commonwealth and hence of other Pacific peoples. This is a concentrated national effort which should serve as model for other countries, is indeed already doing so for New Zealand (the United States, in fact, is now directly benefitting from some recent CSIRO — Australian — discoveries). In both antipodal countries the large-scale renovation of great but outmoded science museums is in full swing. Related to it, and also good to see, is the expansion of university science departments along with that of the institutions themselves, some of which have entire new campuses under construction. At the heart of this

*It is a pleasure once again in these pages to acknowledge with deepest thanks a personal indebtedness not only to the Trustees of the John Simon Guggenheim Memorial Foundation and the Trustees of The San Francisco Foundation, but also to the many good friends whose belief in the validity of the contemplated venture actually became the assurance of its getting under way; and finally, it is only right here to call special attention to the extra duty so splendidly performed — as the last four *PD* issues show — by those versatile members of the Academy staff who were called upon with a minimum of briefing to take over editorial and production tasks while still carrying on with their regular assignments; nor does it seem unsuitable to mention certain unescapable sacrifices on the part of the absent editor's domestic associates.*

growth is the upswing of interest not only in the advance of general culture but also significantly in science, and in education for scientific careers.

Of all things seen and done during this well packed half year, nothing can equal in sheer immediate satisfaction nor in lasting worth the experience of discovering people. There were meetings in remote mountain valleys with folk not entirely emerged from the Late Stone Age, people whose way of life, whose very existence in the present world are facts of high intrinsic interest. Touch and go, one can only exchange with them the sparks of universal human curiosity, courtesy, and — more often than not — humor. One goes on from such contacts, not enriched by friendship on a personal basis or by meeting of minds at a common level of background and information, but glad nevertheless to be reminded that men are not yet reduced to a dull uniformity of mind, manners, and mores. And at the opposite pole there were those quickening contacts with ripened minds and matured personalities or with keen and eager young entrants into the frontiers of knowledge, from which one returns a little wiser in respect to understanding and insight, far richer in fellowship, and — best of all — with new friends.

Shifting now to the broader view, the design for growth becomes visible. On every hand vistas of knowledge swing into focus — vistas waiting to be penetrated by the discoverer's eye and mind, vistas clearly revealed to a few but waiting a medium of transmission to the sight of many, and vistas well known to one side of this world but not to the other. *Pacific Discovery* is still a small

projection screen with a limited range. It can become a large screen, capable of beaming wider and deeper views of knowledge from all parts of its Pacific amphitheater to all eyes and minds within it.

Every day there are more people in this huge amphitheater than there were yesterday. We are born within it, we are migrating here to stay, we are coming in for the view and returning whence we came — with our own horizons widened. We who are of the Pacific are increasingly in need of a common medium for the exchange of views, for the spread of knowledge about ourselves, the lands and islands we live in, the ancient, ageless, ever-changing natural world around us. For the Pacific World is no longer a scatter of islands contained by a ring of nations themselves remote in space, time, and viewpoint both from the islands and from each other. Such a medium as we are challenged to make of *Pacific Discovery* would not only increase the store of common knowledge; it would aid the solution of common problems, build mutual understanding and regard, and set people moving, through its encouragement of travel, towards the most rewarding experience of all — that of meeting others in far places for the exchange of thinking, the sharing of culture, and the making of friends.

When *Pacific Discovery* in time becomes a vital force in the accomplishment of these purposes it will be living up to its name. It will become "*The Journal of Nature and Man in the Pacific World*"; it will be helping the Pacific World to discover itself.

D.G.K.

Honolulu, 25 April 1958

INTRODUCING ALASKA'S LA

THE RECREATIONAL ATTRACTION of any area is intimately related to its landscape, and this in turn is a reflection of its geologic history. If the relationships are obvious, enjoyment comes at once, both from viewing the landscape and from contemplating the processes by which it was produced. Thus the symmetry of a high-arching natural bridge may do much more than please the eye; it may give fuller pleasure by rousing the mind to thought of the age-long erosion by which it was shaped. Geologic explanations serve to deepen understanding of how scenes have come into being. Niagara, Grand Canyon, Crater Lake, Yosemite, Yellowstone, Mount McKinley, or any other spectacular landscape takes on new meaning when one realizes it to be the last of a long series of changing landscapes, the product of relentless forces acting usually at almost imperceptible rates for millions of

years. The thrill of historic insight is then added to esthetic pleasure.

"Beneath and behind all the outward beauty of our lowlands, our uplands, and our highlands," wrote Sir Archibald Geikie, "there lies an inner history which, when revealed, will give to that beauty a fuller significance and an added charm." And it has been well said that whatever withdraws us from the power of our senses; whatever makes the past, the distant, or the future predominate over the present, advances us in the dignity of thinking beings.

No page in history can be fully understood without knowledge of the pages that went before; neither can a landscape be properly interpreted without knowledge of its geologic background. The geologist viewing a familiar landscape, sees in his mind's eye other views that made the present landscape possible; an



S LANDSCAPES

John C. Reed & Howel Williams

enchanter's wand seems to wave over him and by some strange magic blends the past with the present. Geologic influence operates no less in the sunny fields of the Shenandoah Valley, the mist-shrouded mountains of Puget Sound, and the rocky farmlands of New England, than it does among the ice-clad peaks and erupting volcanoes of Alaska; it is by no means confined to bizarre, unusual, or outstanding scenes, although these have special interest and value for purposes of recreation.

Two things must be emphasized above all else if the evolution of Alaska is to be understood: the immensity of geologic time, and the fleeting character of all landscapes. . . . The oldest known rocks in Alaska belong to the Precambrian era; they are, therefore, more than 520 million years of age. And yet, because these rocks were once sediments laid down in the sea,

there must be still older rocks, now concealed, from which they were derived. During the long Paleozoic era that followed, from 185 million to about 520 million years ago, the open ocean rolled over most of what is now Alaska, for virtually all of the rocks of that era bear unmistakable signs of having been sediments, lava flows, and volcanic ashes laid down beneath the sea. The records of these ancient times are too fragmentary, however, to permit a clear account. Too many early pages of the story are missing, and many of the pages are too badly torn to decipher.

During the first part of the succeeding Mesozoic era, that is, during the Triassic and Jurassic periods, from about 130 million to 185 millions years ago, seas continued to occupy most of Alaska, and enormous outpourings of lava took place from submarine and island volcanoes. The products of these tremendous

Shishaldin volcano, Unimak Island. (U.S. Navy photo, October 1942; from *Landscapes of Alaska*, University of California Press, Berkeley and Los Angeles)

eruptions, the Nikolai greenstones, are now to be seen widely distributed in the southern part of the Territory.

From about the middle of the Jurassic period onward, strong earth movements affected Alaska. These movements were by no means continuous, nor did they take place everywhere at the same time. But at intervals, now here and then there, the earth's crust was buckled and fractured, producing great arcuate uplifts and intervening troughs. Indeed there is nothing more striking in the geologic structure of Alaska than the arcuate arrangement of its fold-belts. This accounts for the long, majestic curves of its major mountain ranges.

Look at the . . . physiographic provinces of Alaska.* Note that except for the Brooks Range, which is slightly convex toward the south, and the Aleutian arc, which is much more so, all of the other mountain ranges are arranged concentrically around the Gulf of Alaska, and are convex toward the north. They look like a succession of advancing waves. The crest of the present Brooks Range coincides roughly with the crest of an original upfold; in other words, this range has stood higher than the adjacent areas ever since it was first elevated from the sea in Jurassic times, about 130 million years ago. But quite the opposite is true of most of the other mountain ranges. Surprising as it may seem, the crest of the gigantic Alaska Range coincides approximately with the deepest part of a huge downfold in the earth's crust, and the impressive Chugach-Kenai-Kodiak mountain chain likewise rises on the site of a major downfold. This is why the youngest Mesozoic rocks of the Alaska Range lie along and near

*Reference to a text map is omitted here. See any good relief map of Alaska.—Ed., PD.

the crest, flanked on the north and south by older rocks that dip inward, beneath them.

The earth is forever in motion. Its crust never ceases to pulsate, responding to gradual and fitful changes underground. Parts of the crust are sometimes elevated by being upfolded into anticlines or into still larger arches, called geanticlines. These upfolded belts may then be wiped out by erosion, or may even change into elongated troughs as adjacent belts in their turn are uplifted. At other times, parts of the crust are raised less by folding than by more or less vertical, bodily uplifts. But no matter how the uplifts are produced, many are accompanied by intrusion into the earth's crust of colossal masses of molten, igneous material. That is why granites are so often found in the cores of mountain ranges, for they result from slow cooling and crystallization, deep beneath the surface, of material that was injected while hot and partly liquid. Some geologists suppose that the parent liquid forms by partial melting of deeply buried rocks; others say that the molten material rises from still greater depths where, owing to release of pressure or accumulation of heat by breakdown of radioactive substances, crystalline material is converted to liquid that then rises toward the surface.

In any event, intrusion of enormous volumes of relatively light, partly molten material tends not only to buoy up adjacent parts of the earth's crust, thus contributing to major uplifts, but also brings about recrystallization and metamorphism of the invaded rocks, and is accompanied sometimes by formation of valuable mineral deposits.

Uplifted belts, once they rise above the sea, are immediately subject to denudation, and debris is carried down from their flanks either into intermontane troughs, or, more commonly, into adjacent submarine

Presenting the Introduction to Lands

depressions. And as sedimentary debris accumulates in these basins, their floors subside beneath the growing loads. Long continued sagging thus results in major downwarps or geosynclines. And, in due time, geosynclines, together with their content of sedimentary and volcanic rocks, may be buckled and fractured by earth movements, and their bottoms may be partly melted to yield batholithic intrusions of granite. And so the former troughs become new fold-mountain ranges with granite cores. Then these in turn are attacked by erosion and their waste returns to the sea whence it came. The cycle starts anew, for the sea is both the grave and birthplace of mountains.

Alaskan landscapes in focus

Our images of the ancient seascapes and landscapes of Alaska become less blurred as increasing evidence

Polygonal patterns of ground from repeated thawing and freezing. (U.S. Navy photo; from *Landscapes of Alaska*, University of California Press)



brings them into sharper focus. About 140 million years ago, during the latter part of the Jurassic period, the ancestral Brooks Range first rose from the sea. At the same time, the Seward Peninsula was uplifted, as was most of south and southeast Alaska, and in many places these uplifts were due to folding and intrusion of granite batholiths. But already before the Jurassic period had come to an end, some of the resultant mountains, for instance the ancestral Talkeetna Mountains, had been worn down below sea level.

During early Cretaceous time, between 100 million and 130 million years ago, parts of the present Arctic Slope emerged from the sea, although most of it remained submerged. At the same time, parts of interior and southern Alaska were occupied by the sea, and lavas and ashes accumulated there between layers of marine sediment. Then began a long interval of intense deformation, lasting throughout most of mid-Cretaceous time, when the whole of Alaska, from the Brooks Range southward to the Coast Range, was subjected to strong earth movements, and over vast areas folding and faulting were accompanied and followed by renewed injection of large batholiths with consequent metamorphism of the invaded rocks and formation of new mineral veins.

Once more, however, the elevated regions were attacked by erosion. Sediments carried by streams from the Brooks Range and Seward Peninsula were deposited in adjoining seaways, one to the north, on the present site of the Arctic Slope, and another to the south, the Koyukuk geosyncline. On the present sites of the Alaska Range, Nutzotin Mountains, and Matanuska Valley, sediments were deposited in lakes and in stream channels while peat accumulated in marshes, later to be converted into the coals of the Cantwell formation. Subsequently, about the close of mid-Cre-

the Brooks, Alaska, and Coast ranges stood high, and fluvial sediments accumulated on their flanks while adjacent volcanoes erupted lava and ash.

Widespread uplifts marked the close of the Cretaceous period. The sediments that had long been piling up within the marine trough on the present site of the Chugach-Kenai-Kodiak chain were folded and raised above the sea. Uplifts were so general that at the dawn of the Tertiary era virtually the whole of Alaska except the fringes stood above sea level.

The Eocene period, between 40 million years and 60 million years ago, was one of extensive volcanic activity. It was then, for instance, that many of the lava flows of the Wrangell Mountains were erupted. It was also a time when stream- and lake-sediments accumulated in large and widely scattered intermontane basins, and when vast peat swamps were prevalent, such as those that gave rise to the coal deposits on the north side of the Alaska Range and those in the Cook Inlet-Susitna Lowlands. The climate was warm temperate to almost subtropical, so that *Metasequoia* trees flourished as far north as the Arctic Slope.*

Renewed earth movements took place during the Eocene period. Parts of interior Alaska, the Alaska Range, and lands bordering the Gulf of Alaska were especially affected, and the movements there were once more accompanied by intrusions of granite and by mineralization. And yet before the start of the succeeding Oligocene period, the newly elevated regions had already been reduced by erosion almost to sea level. It seems likely that the landscape of Alaska was never more subdued or uniform than it was during Oligocene time.

Throughout the succeeding Miocene and Pliocene epochs, that is, from one million years to thirty million years ago, the extent of Alaska was not much different

taceous time, the site of the Alaska Range was again deformed by folding on a large scale. This deformation, however, was not the one responsible for the present height and form of the range; indeed the summits of the mid-Cretaceous Alaska Range generally lay north and south of the present crest, which then was relatively low. Erosion and repeated uplifts during post-Cretaceous times account for the transformation.

During late Cretaceous time, from about 60 million years to 80 million years ago, seas continued to inundate most of the Arctic Slope, and volcanic eruptions contributed layers of ash to the marine sediments that accumulated there. Seas were also present in parts of interior Alaska, and they continued to occupy the present site of the Chugach-Kenai-Kodiak mountain chain. On the other hand, the Seward Peninsula, and

from what it is today, only part of the Arctic Slope around Barrow and some of the present coastal lowlands fringing the Gulf of Alaska being submerged beneath the sea. Volcanoes were numerous and widespread, especially in the Seward Peninsula, in the interior of Alaska, in the Wrangell and St. Elias ranges, in the Matanuska Valley, in the Alaska Peninsula, and in the Aleutian Chain. Intermittent uplifts accompanied the volcanism, reaching a maximum about the close of the Pliocene period and the beginning of the succeeding Quaternary era. The eastern end of the Arctic Slope, and the Brooks, Alaska, Chugach, and Coast ranges were probably uplifted most; in fact, the Chu-

*See Ralph W. Chaney: "Redwoods Around the Pacific Basin," *PD*, September-October 1948, with accompanying map.—Ed., *PD*.

to **Landscapes of Alaska, edited by Howel Williams**

gach Range rose so high that already in Pliocene time glaciers covered its higher slopes.

The climate of Alaska had been growing cooler throughout the Tertiary era. Ultimately, about a million years ago, the Ice Age began. Glaciers waxed and waned, retreating during warm interglacial spells and then expanding again. When they were largest, almost all of the high ranges were buried completely by gigantic sheets of ice. Long tongues moved down the mountain valleys, coalescing below into colossal piedmont glaciers many of which spread far out to sea, just as the ice sheets of Antarctica do today. . . . How these enormous glaciers sculptured the landscape, and how, as they retreated, they left in their wake moraines and outwash plains dotted with countless lakes, is told in [*Landscapes of Alaska*]. The principal ranges and valleys of Alaska were already in existence before the Ice Age, but the rugged carving of the mountains and the detailed modeling of the lowlands are mainly the work of glaciers during the last million years.

Volcanoes erupted intermittently throughout the Ice Age, but they were not as widely scattered as those of Tertiary time. Extensive outpourings of basaltic lava continued in the Seward Peninsula, but most of the volcanoes were concentrated in those parts of Alaska where they are still most numerous, that is, in the Alaska Peninsula and in the Aleutian Chain. During the Ice Age also most of the principal mountain ranges were uplifted, and some of them, such as the St. Elias Range, still continue to rise. The signs of these recent uplifts are graphically recorded by wave-cut marine terraces high above the present sea level.

A final word. Alaska was the gateway through which man entered North America. To the archaeologist is left the fascinating task of determining just when the first immigrants arrived, but already it is known that they crossed from Siberia toward the close of the Ice Age, when, owing to the lowering of sea level consequent upon growth of the glaciers, the Bering Strait became dry land. . . .

Such, in briefest outline, is the geologic history of Alaska. . . . Alaska is indeed a scenic wonderland. It has lakes, rolling plains with magnificent distances, rugged mountains with snowy crags overlooking sheltered alpine valleys, glistening glaciers, and steaming volcanoes, all in bountiful profusion. Here is Mount McKinley, its top 20,300 feet above the sea, the highest peak on the continent. Southwest from the mainland extend the Alaska Peninsula and Aleutian Chain, stretching 1,500 miles across 32 degrees of longitude to Asia, and studded with more than eighty volcanoes. In southeast Alaska the "Inside Passage" winds among rocky wooded islands and through deep, ice-scoured fiords. In the far north, beyond the Arctic Circle, an apparently limitless coastal plain, with perennially frozen subsurface and myriads of lakes, slopes gently to the polar ocean. . . .

The sweeping arc of the Pacific mountain system defines the Pacific border of Alaska, rising as a giant barrier between the ocean and the broad interior and western Alaska region. To the north lies the little-known Brooks Range, an immense series of rugged highlands that forms the northwestern extension of the Rocky Mountain system of the western United States and Canada. Still farther north stretches the tundra of the Arctic Slope. The characteristic geologic and topographic features of each of these regions have of course exerted a powerful influence on, in fact have largely controlled other features of, the natural environments — their climate, vegetation, accessibility, inhabitants, industry, and development. . . .

And so, here is Alaska — vacationland unparalleled — its mountains, rivers, glaciers, fog-swept shores, limitless tundra; land of the sourdough, Eskimo, and Indian; but also land of budding industries, great military bases, networks of airlines, and crossroad to the Orient.

Landscapes of Alaska: Their Geologic Evolution. Prepared by members of the United States Geological Survey. Published in cooperation with the National Park Service, United States Department of the Interior. Edited by Howel Williams. University of California Press, Berkeley and Los Angeles. 1958. xii + 148 pp., frontis. in color. 23 halftone plates, 6 maps, 3 text figs. \$5.00.

Landscapes of Alaska is one of those uncommon books that sets a standard. Readers familiar with Wallace W. Atwood's 20-year-old *Physiographic Provinces of North America* will perhaps see in it the foreshadowing of a style in which description of land forms can be lively, clear, non-technical enough to invite its reading for pleasure as well as for information. Telling, as it does, the story of a relatively small part of the continent, the present book—result of some inspired thinking and dreaming by George Collins of the National Park Service, Howel Williams of the University of California, and others engaged in Alaska surveys within the last few years—brings the style and the approach to full flower. Detailed treatment of a smaller area permits unhurried pace, full color and flavor.

After a Foreword by Conrad L. Wirth, Director, National Park Service, and George Collins' Acknowledgments, the Introduction, here reproduced nearly in full, sets the tone for the chapters on particular areas. These with their contributors are: "Southeastern Alaska," John C. Reed; "Gulf of Alaska Area," Don J. Miller; "Wrangell Mountains" and "Copper River Plateau," Robert F. Black; "Talkeetna Mountains" and "Cook Inlet—Susitna Lowland," Farrell F. Barnes; "The Alaska Range," Clyde Wahrhaftig; "Alaska Peninsula—Aleutian Islands," Howard A. Powers; "Lowlands and Plains of Interior and Western Alaska," Robert F. Black; "Interior Highlands of Western Alaska," Joseph M. Hoare; "Interior Highlands of Eastern Alaska," Robert M. Chapman; "Seward Peninsula," J. P. Hopkins and D. M. Hopkins; "Brooks Range" and "Arctic Slope," George Gryc; "Islands of the Bering Sea," George M. Flint, Jr. The book closes with an appended "Geologic Time Scale," a glossary, and an index of geographical names.

One of the qualities of the book is that it flows through the many contributors—all expert geologists, by the way—with the same clear and vigorous simplicity, much credit no doubt being due the editor. Another is the beauty of

(Continued on page 32)

ESKIMO HUNTERS

2. THE BIRD SHOOTERS

RICHARD D. TABER

FOR THE ESKIMO HUNTERS of Wainwright, the migration of the whales in early spring is the first of many northward movements. In long lines abreast, eiders fly north over the open leads from their wintering grounds in the Aleutian Islands, south of the ice pack. Whalers waiting by the water may catch the eiders to pass the time; they cannot shoot them because gunshots near a whaling camp might frighten off the whales.

But as the eiders fly quite low, almost skimming the water, the "Eskimo shotgun" comes into play. This consists of three cords, each about 18 inches long, tied together at one end and each cord weighted at the free end. Similar to Argentine bolas, these "shotguns" are thrown whirling through the air, aimed to wrap around the neck or wings of a passing bird.

In May, as the days grow longer and spots of

tundra begin to emerge from the snow, ptarmigan appear from their wintering ground in the willow thickets of the interior. For some distance around the village, the ptarmigan are hunted down by the Eskimo boys of Wainwright and a great many of the birds end up in the stew pot. However, the tundra is so immense, the species has adequate protection.

The arrival and nesting of birds from the south reaches a peak in June. The days are long, but the summer is short. There is no time to dawdle away the days with a protracted courtship, especially among the larger species, such as geese and brant, which have a long period of incubation and pre-flight development. There is no time for successful re-nesting if a nest is broken up.

At this season, the Eskimos rob every nest they find. The eggs of ducks, geese, gulls, jaegers —

▲ In the early Alaskan spring, eider ducks begin to fly north over the open leads, and Eskimo hunters follow by dog-sled.
(Photographs from Kodachromes by the author)



← Eider ducks are no longer an important source of meat for the Eskimo, but their shooting enables the Eskimo man to keep up his prestige as a hunter — this means a great deal socially.

ψ Two hunters land a mixed bag of seal, grizzly bear, black brant and yellow-billed loon — a boatload of prestige!

all eggs, in fact, big enough to bother with — are gathered up and put in the cold cellar by the Eskimos. But the Eskimos are always careful to make one exception. Whenever a nest is robbed — no matter how many eggs it has — one egg is always left. This satisfies the nesting bird, which continues to incubate its single egg and raise its lonely chick, and tends to insure that there will be birds to nest in the vicinity again the following year.

It is the immensity of the tundra and the sparseness of the human population, again, which protects the birds. Travel for the Eskimos is difficult during the nesting season. The ice is rotting and going out of the rivers and much of the land is free of snow; there is too little good ice for boats. Overland travel afoot is like walking on a pile of wet mattresses with an occasional trip through the bathtub.

In most years, because of these conditions, the egg collectors have only a smattering of success during the nesting season of June and early July. One man the author met still looked back with



fondness on a particular spring when he and his daughters brought home ten dozen eggs. Most years bring less and the total effect of the egg collectors on the bird populations, except right at the edge of the village, must be negligible.

On the first east wind of late July the eiders start to move. These are king and Pacific eiders,

The immensity of the tundra, the sparseness of Wainwright's human population, and the length of the arctic winter afford protection for the migratory bird population of northern Alaska.

mostly males. These species of birds do not have time to bother with family life. Shortly after breeding takes place the males leave the females to raise the babies, joining large all-male flocks on the open water.

With the first tail wind these birds, with a few other species, move west and south along the coast. They pass along lagoons, crossing certain points and bars, on a route that has been observed and remembered by generations of Eskimo hunters. One famous crossing is at the base of the long spit which marks Point Barrow. Whole Eskimo families, in anticipation of the eider flight, move to set up a shooting camp at this spot.

Tents blossom on the gravel, often with washing machines at their entrances, and rough racks are knocked together to hold the bundles of birds which will accumulate during the shoot. The hunters fan out with their shotguns and large supplies of ammunition to crouch in partial concealment and watch for the birds. Flock after flock, in long lines abreast, fly low along the coast. As a flock approaches, the hunters break into a babble of enticing calls and those under the line of flight rise to fire.

Bird shooting, as a means of securing a supply of meat, cannot compare with hunting seal, whale, or walrus. The expenditure of time, energy, and ammunition, is too great in proportion to the tangible return. In the past, waterfowl were taken in a much more economical manner and were utilized more fully than they are today. The big kill then was of Steller's eiders and old-squaw ducks. These varieties raft up in huge flocks on the sea in late summer, when they are molting their wing feathers and cannot fly.

In former times, the little boats of the hunters slipped out from shore and formed an arc around such a raft containing hundreds of birds. Slowly the boats would converge and drive the birds shoreward. At a certain point on the beach they were herded ashore and over a low pass to a shallow pond. Once they were on the pond, the whole village population rose from concealment to club the birds. In those days the skins of the eiders with their heavy down were used to make warm underclothing, but this practice has since been abandoned by the Eskimos.

The hunting of eiders and of other migratory waterfowl fills a need which is more social than



economic — the need of the Eskimo man to be a hunter. Although development of the Arctic has encouraged many Eskimo men to become proficient in new lines of work, such as tractor driving or construction, there still remains the strong feeling that the proper pursuit for a man is hunting. A man who buys his meat instead of providing it himself loses something in general esteem, a matter important to most Eskimos. Wildfowling provides hunting activity without much discomfort or inconvenience, so if the birds are expensive the prestige is not.

One still vigorous old man kept a thriving store. On slow days he sat in his loft, building exquisite ship models of rich black baleen, models for which there was a ready sale. His economy had two firm props, business and craftsmanship. Yet on one July day half of his conversation, while he delicately rigged a sailing umiak, was an apology. He offered no justification or defense for the creative work which took up his time, just an apology because he wasn't out seal hunting *with the men*.

As the ponds freeze over in late August there is one final southward movement of waterfowl. The young birds have at last grown strong enough for extensive flights. Again the eiders migrate over the shooting camp at Point Barrow, but now instead of adult males the flocks consist of females and their young.

The eiders are hunted by the Eskimo hunters from Wainwright too, but their chief autumn waterfowl hunt is for the black brant. This small, dark maritime goose breeds in fairly large numbers along the Arctic coast. At first during its southward migration, it moves across country, along river valleys, and by-passes Point Barrow. Striking the coast near Wainwright, the birds turn south along the lagoons.

The flocks rest at night along the way and, being gregarious, are easily lured by the calls of the hidden Eskimo gunners. When the first birds have been killed, their bodies are propped up to serve as decoys and the next flock comes in even more readily than the first. On a favorable day during the height of the migration, a single hunter may kill more than 100 birds. At two or three pounds apiece, these will add up to the weight of a seal or two. Autumn gunning for waterfowl is as enjoyable for the Eskimo as it is for the duck hunter in the States.

(To be concluded)

Unique structures of cliff and mesa,
priceless pages of America's past
written in the stone and clay
of the ancient Southwest—

Shall we let them crumble into
meaningless dust, through neglect
and abuse? . . .

No! says our National Park Service,
their official custodian—

But it will take more than money,
it will need the care and concern
of all of us, to preserve these, our
Southwest National Monuments

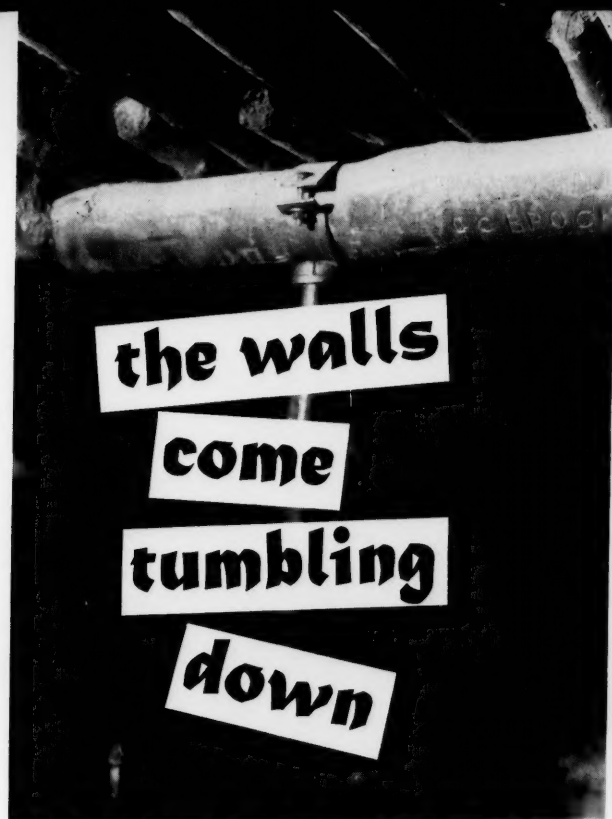
ANNETTE RICHARDS PARENT

IN THE MODEST OFFICE of one of our Southwestern National Monuments, a young archeologist bewailed, "Oil, gas, and uranium hunters are tearing the country apart!" He continued, "In another 20 years, archeology will be doomed. And we are gnashing our teeth in frustration."

These provocative statements shocked me into conducting a personal investigation of the current status of American archeology in general and of our archeological national monuments in particular. The overall story? Not very reassuring.

On June 8, 1906, the Federal Act for the Preservation of American Antiquities became law. It provided a penalty for anyone who disturbed any historic, prehistoric, or scientifically interesting object on federally-owned or administered land without a permit issued by the Secretary of the





Interior. It recognized that extricating artifacts from old ruins without relation to their environment destroyed irreplaceable scientific evidence.

Most states have similar laws protecting archeological sites on state land. But both state and federal antiquities acts have been inadequately enforced. Though commercial pot hunting has ceased, individual amateur digging is on the geometric increase as population, leisure and interest in archeology snowball — especially in the Southwest.

The Mimbres ruins of southern New Mexico are almost entirely gutted by pot hunters. An entire chapter in the Hohokam culture around Gila Bend, Arizona, has been destroyed by one private collector.

"Kin" is the Navajo word for "house." One unexcavated prehistoric dwelling at Chaco Canyon was partly shoved over a cliff when a water tank was installed for sheep. Its remains are appropriately dubbed "Kin Bulldozer."

A more serious threat than pot hunting or vandalism is power equipment and giant earth-moving machinery which carve up the country while constructing roads, pipelines and dams and

To keep them from tumbling down, walls and roofs of ancient structures in national monuments need constant bracing. This is in Montezuma Castle, Arizona. (NPS)

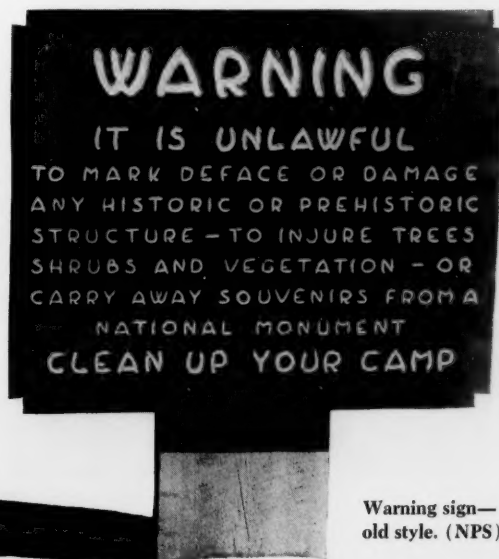
leveling land for housing additions and agricultural developments. Hundreds of still unexplored square miles may be covered with the reservoir waters from a single dam. A new highway or pipeline through unknown archeological territory can do irreparable damage. Through "pipeline," "highway salvage" and "river basin salvage archeology," archeologists are mustering their forces to save imminently threatened areas. But this is a separate story.

Our interest here is in our 19 National Park Service archeological areas which are legally protected in perpetuity. Containing some of the best of America's known prehistoric treasures, they are infinitely more valuable because all around them, the earth's hitherto untouched surface is being chewed up at an unprecedented rate. Peppering the arid Southwest in particular, they afford a fairly representative picture of life in that region before the white man came in with Coronado 400 years ago.

They are guarded against unlicensed digging and are preserved from the ravages of nature. But are they *really* safe?

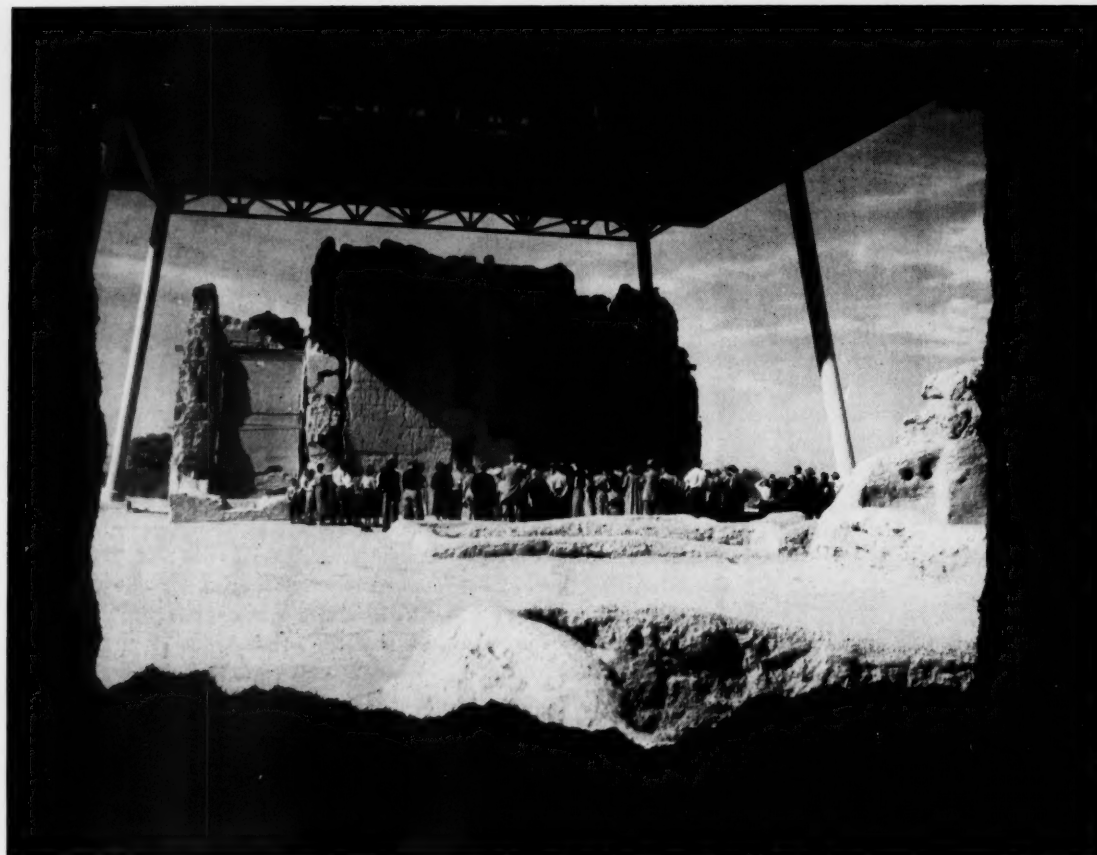
Established by presidential proclamation to be preserved for and to be enjoyed by all Americans for all time, they constitute a paradox. If they are preserved, how can they be enjoyed? If enjoyed, how preserved? They were made public property — and the public is wearing them out! By sheer force of numbers, we are "loving them to death," says Conrad L. Wirth, Director of the National Park Service. "Human erosion" is taking a costly toll.

The human traffic jam created in our National Park System by the recent population explosion



Warning sign—old style. (NPS)

◀ Some Park Service rangers live in worse homes than this vandalized adobe in Big Bend National Park. (National Park Service photograph)



Five and a half centuries old, Casa Grande in Arizona is a continuous stabilization job for the Park Service. Although a high roof gives some protection from rain, crowds of visitors cause much attrition to the crumbling four-story mud watch tower. (NPS photo)

is particularly serious in the archeological areas whose chief attractions are vulnerable, man-made structures of wood, stone and mud. How can their fragile walls stand up under the impact?

Obviously, many are not. Two of our oldest areas are succumbing in their fifty-year bout with the public. Montezuma Castle was closed to visitors in 1951, its precipitous ladders removed to insure its isolation. Mesa Verde is a madhouse with three times as many cars and people as it can handle. Three of its main primitive dwellings have been closed—Spruce Tree House, Square Tower House, and the magnificent Cliff Palace. The relatively tiny and unpublicized Tonto National Monument has more travel today than did Mesa Verde National Park in 1935! Archeologist Philip Welles foresees the entire structure fenced off permanently in twenty or thirty years—probably much sooner—when visitors will see the interior only through closed circuit television, movies, displays, charts, and diagrams.

Stabilization men wage an unceasing battle to enable the old dwellings to hold their own. A ruin

survives better if not excavated, for the earth protects the ancient walls and artifacts from the elements.

At Chaco Canyon, I talked with Gordon Vivian, one of the archeologists responsible for keeping the Southwestern National Monuments in suspended ruination. A corps of twenty Navajos was repairing the four-story-high north wall of Pueblo Bonito to keep moisture from rotting its surprisingly high percentage of wood. They were cementing the top layers stone by stone. A huge wooden beam set in cement braced the dangerously leaning wall. This was the first major stabilization work on Pueblo Bonito in fourteen years.

Casa Grande's four-story mud walls claim Vivian's constant attention. Human wear and tear is severe. And despite a broad protective roof, driving wind and rain play havoc. Will modern patchwork completely replace the original plasterwork?

Aside from stabilization and salvage (as at Canyon de Chelly when river floods threaten to destroy ancient burials and artifacts), no major archeology has been done in any Southwestern Na-

tional Monument since the 1930's. What small exploration funds there were got cut off sharply a few years ago. And stabilization, which merely seeks to maintain a precarious status quo, always lags far behind. . . .

After a lifetime of lean years financially, thanks to the warm reception to the new ten-year Mission 66 development program, the Park Service was given five million dollars more than it requested for its first year's expansion! But an election-conscious Congress does not come every year, cost estimates proved much too conservative, and travel has skyrocketed far beyond what park officials envisioned.

The Southwestern National Monuments alone realized *one half* of their anticipated visitor increase over a ten-year period in *one year*—or a 34% increase! To make matters worse, because of their isolated locations and relatively small individual construction requirements, contractors' bids are prohibitive—\$33,000 for a modest two-bedroom house, for example! Besides a \$150,000 "visitor center" building plus a utility area for Chaco Canyon and a small utilities center for Aztec Ruins, no other buildings are on the agenda for the archaeological areas.

Despite the staggering increase in travel, the Southwestern National Monuments gained no additional personnel in 1956. In 1957, they hoped to acquire eight more men and thus for the first time to staff each area with a minimum of two. Superintendent John O. Cook of Montezuma Castle typifies the manpower shortage: he does his own janitor work — emptying garbage cans, cleaning toilets, etc. Sunset Crater has no ranger at all.

The chronically poor Southwestern National Monuments are sometimes called "the second class citizens of the Park Service." One half have only pit toilets and no running water. One half of their personnel still live in trailers and shacks.

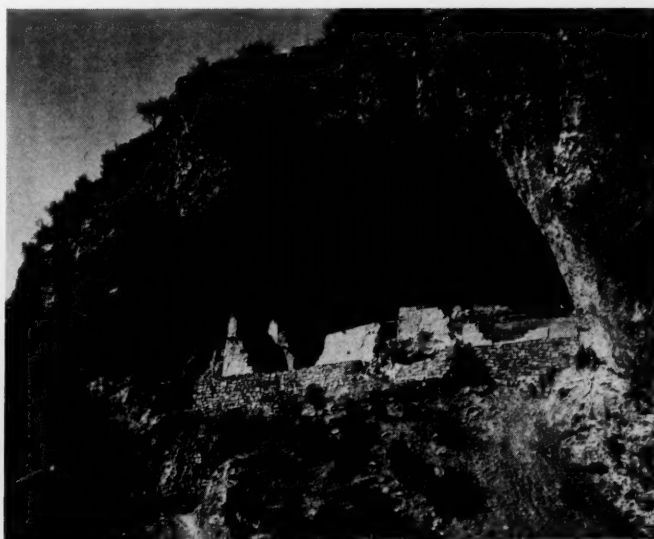


Lack of museum space is appalling. Manos, metates, jewelry, textiles, baskets, clothing, mummies, pottery and tools are scattered all over the world instead of in their native locations. The "museum" at Canyon de Chelly is an open porch, at Wupatki a corner of a crowded basement office, at Chaco Canyon one end of an old C.C.C. building.

In twenty years, the Southwestern National Monuments have added only three new storage rooms. And even these were disturbed: one was given to the concessionaires; one had a well built in it; and the one at Casa Grande is accessible to the public so that artifacts disappear or are shopworn. Other storage space includes furnace rooms, garages, an old cistern at Aztec Ruins, the attic above the ladies' room at Tuzigoot, and a tent house in a hogan at Canyon de Chelly. Because of these inadequate facilities, discoveries like the rats' nest in the chest of a stored mummy rescued from Standing Cow Ruin at Canyon de Chelly are not surprising.

Vandalism runs rampant when there is insufficient personnel to patrol or to interpret. With the self-guided tour a necessity because of the ranger shortage, tourists are often left to their own devices.

On the trail at Tonto is the following legend:



Two photos of Arizona's Tonto ruin, taken about a quarter century apart, show graphically how rapid the erosion of such structures can be. The one at the left was taken in 1920, the other is a recent one. Note how the upper half of the high wall at the right is entirely gone. (NPS)



Every month visitors carry away a ton of yellow sulfur and travertine from the top of unguarded Sunset Crater, scene of a prehistoric land rush. (NPS photo)



Navajo workmen repair a wall at Chaco Canyon. (NPS)

"Warning — Rock Hounds and Pebble Puppies — You Can't Take It With You!" Near the top of Walnut Canyon's Island Trail a smooth stone decorated with pictographs reads: "Notice to all visitors. As the carving of names or the defacement of any object is prohibited by law, visitors who feel that they must mark up something are requested to use this slab from which removal may be less costly to *you*." "Taking only pictures and inspiration, and leaving only footprints and goodwill" is advice frequently printed in the brochures.

Names carved on Newspaper Rock at Petrified Forest and on Inscription Rock at El Morro must

periodically be scratched off. Those at Walnut Canyon are scraped, then burned black. Ruins and trails are used as public toilets in Petrified Forest, Wupatki, Walnut Canyon and Canyon de Chelly.

Vandalism is curbed by signs, rangers, curfews, interpretation, protective devices, and fee charging. People seem to respect something they pay for. It seems reasonable that those who visit a park pay a little more than those who don't. A fee discourages casual picnickers but not the seriously interested.

An increasingly knotty problem is the building of first class roads right by the doors of formerly remote archeological national monuments. Navajo country is being bisected by one north-south and two east-west paved highways to bring speeding visitors within four miles of spectacular Canyon de Chelly and within seven and one-half miles of Navajo, always considered one of the most inaccessible areas.

Roads regulate both quantity and quality of visitors. "Pause" or "pass through" parks like Walnut Canyon or Casa Grande play host to the casual, hurried tourist who makes a brief detour. He wants his "money's worth" of entertainment, not enlightenment, and is souvenir, litter, vandal, and name-inscribing prone. In contrast, the person who arrives at Chaco Canyon, Hovenweep or Navajo has demonstrated his deeper interest by taking the trouble to travel on rough roads.

A veteran superintendent put it this way: "My experience in several national monuments with greatly differing standards of overnight accommodations, and varying types of travel, has convinced me that the most damaging non-conforming use by visitors comes from those . . . primarily attracted to the place by the excellence of the overnight and entertainment features rather than because of the primary values for which the monument was set aside."




"Cushionitis," says Forrest Benson, Superintendent of Chiricahua National Monument, afflicts our modern citizenry. We like to see America from our comfortable car seats — with no dust, exertion, or inconvenience. But if we drive effortlessly to Bandelier and Aztec Ruins, do Gila Cliff Dwellings, Betatakin and Yucca House need to be as easy to reach? To make all ruins equally accessible is "as crazy as building eighty million dollars worth of sidewalks in the Gobi Desert," to quote one frantic archeologist.

According to Dale S. King, Chief Naturalist at Southwestern National Monuments Headquarters, the five "hottest" areas in the Southwest now are Montezuma Castle, Montezuma Well, Walnut Canyon, Sunset Crater and Wupatki. The new Black Canyon Highway has placed Montezuma Castle and Montezuma Well within less than two hours of metropolitan Phoenix. In 1955, 40,000 people came to Montezuma Castle. In 1956, a whopping 140,000 inundated this prize site which still has a year-around staff of only three men. Wupatki had 78,000 visitors in 1954 and anticipates 300,000 by 1966.

But alarmingly, visitors are arriving, good roads or bad. If the Park Service does not enlarge its facilities, its improvements will be ruined by overuse; but if it develops them, it attracts more peo-

ple. In the archeological areas especially, this raises a protective problem of major proportions as damage to delicate ruins can be permanent.

Our archeological national monuments must catch up with existing public use and prepare for the even more incredible visitation expected. They need more personnel to develop safeguards for the ruins, to interpret them, and to keep the physical plant functioning. Protective devices must be installed to preserve the ancient dwellings as well as the artifacts and display material. Trails, wayside exhibits, museums and storage space must be built. Restrooms, parking space, picnic and camping facilities, and in some places food and lodging must be expanded. There should be a continuing program of exploration, salvage and stabilization.

Our Park Service men are able and dedicated. But they need help. Our archeological national treasures are doomed to destruction and eventual oblivion from the very nature of their primitive construction unless drastic action is taken. Simply to protect them by law from pot hunting, mineral prospecting, and heavy earth-moving equipment is not enough. Let us hope that Mission 66 will be fully implemented over the next ten years and that these living monuments of prehistoric peoples will continue to tell their story to all future generations. 





GRA

JAY C. VON WERLHOF

THE California Archeological Survey, of the University of California, has been extending its efforts the past few years to record petroglyphs and pictographs throughout the state. Some of the drawings, paintings, and carvings by California Indians had been known locally for some time. Little had been done, however, to record and study them. Few persons until recently took the works of art seriously. While the spectacular cave paintings near Santa Barbara

16

With stiff brushes of animal hair bound around a stick, Tule-Kaweah Indians made strong lines on the rough surfaces of granite and sandstone boulders.
(Photographs by Pirkle Jones)



*In caves and beneath jumbles of boulders California's earliest artists left their paintings which are now being recorded, before their inevitable destruction, by a survey team from the California School of Fine Arts.
(Photograph by Fran Connor)*

GRANITE GALLERIES





▲ This figure was painted with a white pigment, outlined in black. The Indian painter daubed two coats of thick pigment on the white area with his crude brush.

➤ Left unfinished, this painting's general form was quickly defined with undercoating. The final coat, intended to smooth out the lines and give solid body, was only begun at the lower part of the figure and around the circle. The inside of the circle was blocked in with red which also was used for the line protruding behind the head.



have been publicized and visited by thousands, the art of painting had not been recognized as a meaningful expression of California natives.

In contrast to a written language the interpretation of symbols is not the most fruitful result of art study. Of more significance is the degree of technical mastery in painting or carving. Also to be given consideration is the aesthetic sensitivity felt in the work. And, perhaps the most important of all, the study of art affords another means for tracing intercultural influences. By charting recurring designs or techniques used in art, migrational movements or intertribal contacts can be followed more definitely.

The photographs shown here were taken at Rocky Hill, near Exeter in Tulare County. The California School of Fine Arts in San Francisco, to enhance its own interest in Primitive Art, organized the expedition with the coöperation of the California Archeological Survey. The site is actually made up of six areas along the lower slopes of Rocky Hill. The paintings were found in caves and the undersides of large rock formations. Only a few of the works were fully



exposed on outside walls, lessening greatly the danger of destruction by erosion or vandals that already has ruined so many sites. Paintings, as at Sunflower Valley near Avenal, Orosi, and Primavera, were quite distinct twenty years ago but by now are too weathered to accurately record. Other sites, as the flamboyant series at Hospital Rock, have been damaged beyond recognition by vandals within the past five years. This summer the California School of Fine Arts will conduct field experiments with ultra-violet light in an attempt to reveal work that has been eroded or mutilated.

The symbols painted at Rocky Hill were drawn from natural forms, and are representative enough to be recognized as man, plant, or animal. A few designs are too abstract to identify counterparts in nature. However, these are done well enough technically to permit the assumption that the designs were intentionally abstracted instead of being poor attempts at creating likenesses to nature.

The paintings are products of the Tule-Kaweah tribe. These Indians formed a part of the Yokut nation which occupied the bulk of the San Joaquin Valley from Fresno to Bakersfield, and from the lower slopes

▲ A wide span of time appears in the painting of this surface. An element marred by age barely survives at the left; a younger one at the top is quite distinct. A third element is almost bright in contrast but cruder (compare with the cover photograph as to quality of line, proportion, and connecting of lines).

➤ Pigments came from the earth: red was hematite or iron oxide, plentiful in lower Sierra slopes; white was prepared from Cretaceous foothill strata, the chalk broken into small bits and mixed with animal fat and human saliva as binding agents; black was soot or powdered charcoal. Pigments were mixed in a crucible or on a stone slab with the liquid ingredients. Some plants were chewed for their saliva-producing effect. Colors turned out with an even and opaque consistency.





of the Sierra to those of the Coast Range. The Yokuts were known for their peaceful ways, and the various tribes that made up the nation kept close to their own territorial limits. Within their own borders each tribe found a self-sufficient life that seldom necessitated jealous glances to the lands of neighbors. They ac-

tively traded across the valley, and with a few of the foreign tribes that surrounded the Yokut peoples.

The Tule-Kaweah tribe occupied the central sector of the eastern Yokut territory. Geographically their land was quite varied. From the valley floor at Exeter into the 1,500-2,000-foot levels of the Sierra the In-

Looking westward over San Joaquin Valley from the southern slope of Rocky Hill.

At the large boulder's base is a series of bed-rock mortar holes for grinding seeds, grasses, and other edible plants into meal. Nearby were found large patches of Jimson (loco) weed which the Yokuts used to make medicinal and ceremonial brews. A natural spring near the fenced trough (center right) was the only permanent water source in the area. Paintings were found on all sides of the boulder. Several test holes at this site yielded pot sherds, pit ash, bird bones, and flint.

(Art Adams)



← Plant shapes — white, dividing lines red,
the whole outlined in black. (Fran Connor)

dians found a diversified supply of plant and animal food. Natural springs in the hill regions provided them with water during the months when the creeks were dry.

The Tule-Kaweah were hunters and not farmers. Their animistic religion, tribal organization, codes of ethics and morals reflected their dependence upon accepting the world as it seemed to exist. This was so in their total way of life.

Near the center of their area stood Rocky Hill. Appropriately named, the hill is a chaos of boulders, and rises above dozens of nearby hills that are barren as dunes. The hill was a religious site for ceremonial

→ A complicated series on the inside walls of a cave opening shows some elements badly preserved, others obviously overpainted on earlier ones — example, the lower procession of horned, tailless animals painted over parts of the turtle. In some cases the poor condition may be owing to the painter's using only a single coat. The colors are white, red, and black.

↓ This group is at the opposite end of the same cave, away from wind and sunlight — it is very well preserved. The white and red areas are very distinct. One of the elements is a series of near-circles, an element appearing in only one other example at Rocky Hill.



gatherings held several times each year. At these ceremonies, which ushered in changes of seasons or brought forth initiates into the tribe, dances and feasts were held. On the southwestern slope is a huge boulder (see photo) around which a camp was kept during festivities. The boulder is broken in two, and at some time the halves were painted with murals. Earth movements later brought the pieces close together again, and today only a few inches separate them. The opening is too narrow to observe the full scene, and only the elements nearest the outside can be accurately viewed.

Shamans, or "medicine men," presided over the fes-

CIVILIZATION IN STONE

THE AIRPLANES that lift passengers between Lima and Cuzco fly at such heights that passengers are supplied with oxygen tubes. While Lima is only 500 feet above sea level, Cuzco is 11,000 feet up in the Peruvian Andes. To get over the range, the planes of the Faucett Airlines (the only commercial airline permitted to operate *within* Peru) climb to altitudes of 20,000 to 23,000 feet, depending on the weather.

This high country has bred a race of sturdy mountain folk who for centuries have tilled farms that lie between 12,000 and 15,000 feet. Since the country is so near the Equator, such excessive heights do not bring freezing temperatures, although the early morning hours can be downright nippy. The diesel-powered trains of the Ferrocarril-Cuzco-Santa Ana, the "FCCSA" as it is affectionately called, carry visitors from Cuzco to Machu Picchu over a 12,000-foot pass and do so during twelve months of the year, a feat possible only in an equatorial latitude.

The present-day Peruvian mountain folk are a diversified people whose one common bond is the

Quechua tongue they speak. They are a small people, poorly clad, inadequately fed, many of them wretchedly poor. They dress in ragged trousers, conical felt hats, makeshift sandals, and ponchos. The poncho is of llama wool or alpaca wool and is an indispensable article that serves as overcoat, waterproof, and bed blanket.

Too many of these lowly folk are today, as in the days of the Incas, human nonentities. Where their ancestors were slaves of the Incas, today many are beasts of burden — and fine is the distinction between the two. They pack burdens that would bring voluble protests from two burros. I have seen these wretched commercial bearers dog-trotting through the streets of Cuzco bent nearly double under burdens twice their own weight, perspiration streaming from their faces and a look of utter hopelessness on their agonized features. With all too many of them coca leaves, poppy seeds, and corn beer are habitual addictions which drug them into a state of perpetual insensibility to suffering.

Nevertheless, this same people built a great

tivities because of the religious significance inherent in each celebration. The shamans were the interpreters of nature which was so full of mystery and power. They claimed to communicate with the spirits, demons and ghosts which they felt inhabited every object and act within the natural world. As interpreters and communication experts the shamans were also the tribal artists.

The specific meaning of many paintings cannot at the moment be determined. And there are no Indians in the Yokut area today who can say anything positive about the work.


Ho-En-Nick, a former chief of the Tachi (another of the Yokut tribes), told this writer that paintings were made "long time back, way back," but not during his 85 years or even in the lifetime of his father. It is assumed that paintings still visible today are between 150-300 years old. Those that have been well protected are perhaps as old as 500 years.

Of certainty, the shamans did not paint for the aesthetic experience. Also, there are at least two distinct kinds of work. One is enshrouded in religious meaning, the other has a documentary or communicative purpose. Little is actually known about either.

The religious paintings show evidence of subjects that were meaningful to the tribe, and involve descriptive and explanatory matters pertaining to people, animals and plant life, and spirits. The documentary

and communicative work has only recently begun to be studied. Maps of cemeteries and camp sites, and perhaps other physical features of the tribal area, seem to have been drawn for purposes of record or communication. The shaman was an important figure as interpreter and recorder to the natives. Women did most of the handicrafts in tribal life, and developed an acute sense of spatial relationships. The men, however, who painted on rock walls were not so interested in composition. With rather large surfaces on which to work, the paintings were apparently unplanned. They seem to have been spontaneously created, element by element, and made over long periods of time. Many elements had been placed over older ones, and in several instances the quality of work and painting technique shows considerable variation.

The Survey keeps a chart of the individual elements recorded. By this manner intercultural influences become obvious, as do later introductions of elements into a painting by malicious or ignorant passers-by.

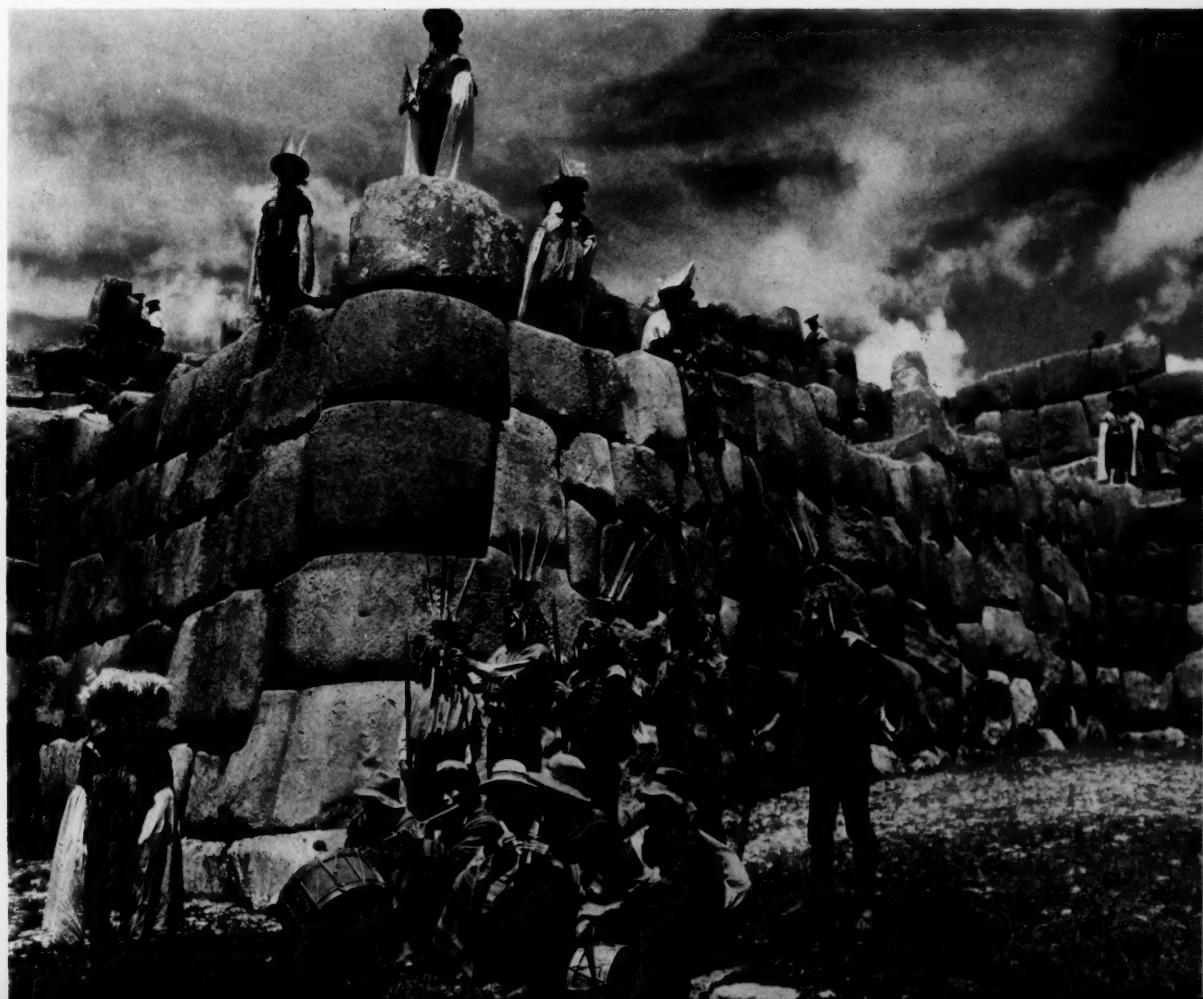
As more and more people turn to the lures of the outdoors and chance upon Indian rock art the defacement of sites becomes more frequent. This defacement, coupled to deterioration by natural elements, seriously limits the life of the art work. For this reason too, the California Archeological Survey and California School of Fine Arts are extending efforts to record petroglyph and pictograph sites in California. 

civilization, one as advanced in many respects as that of the ancient Egyptians, or even — from the technological and military point of view — that of the Romans. Here on the rocky slopes of the Andes these same Indians, who today appear lowly and backward, achieved a state of culture equaled in pre-Columbian America only by the Aztec and Mayan. And the most conspicuous surviving evidences of that Incaic civilization of the Andes are of the very substance of the mountains themselves. They are a network of stone-paved roads, and an array of monumental stone structures which still bring wonder to the modern world.

It is doubtful that any other people handled stone so skilfully and applied it so extensively as the Incans. They worked stone in a way that revealed a deep reverence for the material itself. Other civilizations have used stone extensively in construction. As an example, the Nabataeans, who originally peopled the Valley of Petra in southern Jordan, carved their structures in solid rock. They did not build, they *cut* structures directly in the cliff sides. For decoration they graved the stone

in classical Greek and Roman architectural forms — the valley having been conquered at various times by both those great colonizing powers. Another ancient people, the builders of Angkor in Cambodia, used stone entirely in the construction of their great religious edifices, carving virtually every wall and pillar with elaborate relief. History's foremost architects in stone were the Greeks and Romans. Their magnificent temples, fluted columns, decorated capitals and above all, their statues in white marble, with their almost human, breathing realism, bespeak a supreme grasp of the potentialities of marble as a decorative medium. For all these peoples stone was more than a structural material; it was a medium for the creation of forms having no relation to the natural substance.

The Incan peoples in contrast used stone as stone. They developed stone-cutting techniques unlike those of any other race. They only rarely decorated with carved designs or figures. They dressed their stone as a mason would, leaving the natural texture of the unpolished mineral to serve as its own beautification. The only departure from



Fortress
of Sacsahuaman
at Cuzco,
Peru.
(Pan
American
Airways
photo)



At Machu Picchu the masonry—as in this circular tower—was adapted to the contours of the foundation rock. (PAA)

this elemental treatment was to chip or pit the surface of the stone in a rough-textured grainy effect. This treatment, together with the beveled edges and rounded corners and trapezoidal doorways and portals—broader at the base than at the top—characteristic of all Incan stonework, created a style of masonry that is astonishingly impressive in its simplicity. Here is dressed stone with a beauty which stems directly from the texture of the natural medium. The Incans seem to have worshipped stone. All their gods, temples, niches and altars (they did not *build* altars, they carved them out of standing rock) are rendered in either a soft granite or a harder flint-like stone. It went into their shrines, houses, aqueducts, wells, walls, great sweeping stairways, terraced hillsides, foundations, and fortifications.

The center of Incan civilization and ancient capital of the Incan empire was Cuzco in central Peru. Cuzco is still one of the most fascinating spots in the world. It was the southern capital of the empire as Quito in Ecuador was the northern capital;

for in its great days the sprawling empire stretched 2,000 lineal miles from Argentina, Chile and Bolivia in the south to Peru, Ecuador, and Colombia in the north. Cuzco was linked to its far spread outposts by four paved highways, portions of which are still trod by the llamas of the mountain Indians. In its great day Cuzco was a city with 200,000 inhabitants (today it has about 45,000). Its water supply was ample to supply all needs, irrigation included.

Cuzco is the present-day showcase of Indian stonework. In almost every street of this mountain city are the remains of Incaic or pre-Incaic walls, arches and doorways. On some buildings, over arches and around the doorways may be seen “a few very small snakes and pumas.”*

Cuzco gives evidence of having been occupied by several different civilizations all of which built in stone. In their handling of stone—in the regions where stone was plentiful, for elsewhere they were forced to resort to adobe—the Incans adopted the same incredibly accurate mortarless joints that are characteristic of the older civilizations. They surrounded Cuzco with great walls of stone, the remains of which make it possible to trace their entire course, while many of the streets are lined on either side by courses of perfect masonry.

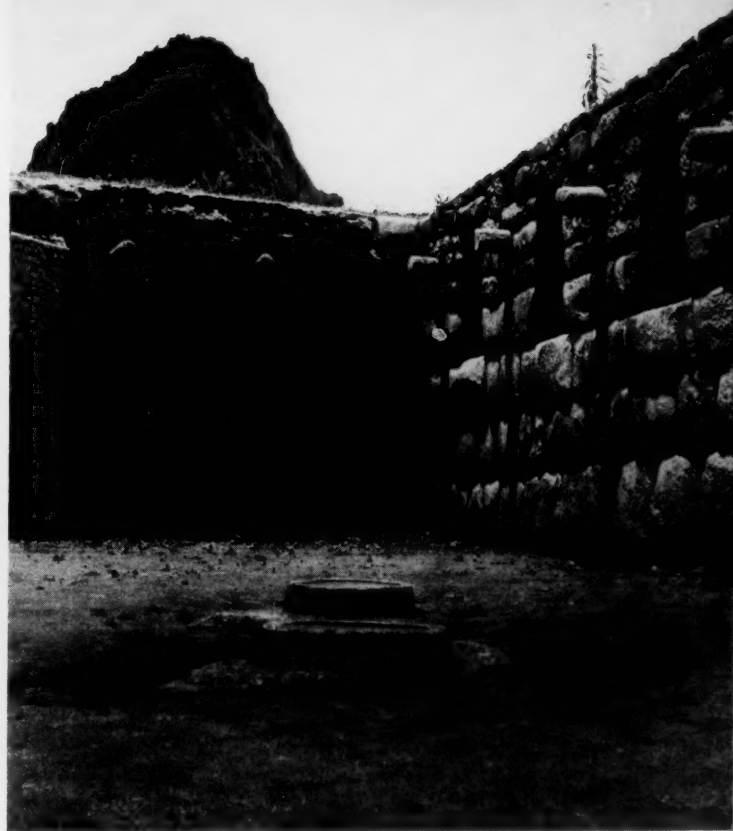
Crowning a hill above Cuzco is perhaps the most massive structure ever conceived by the Incas. This is the gigantic fortress of Sacsahuaman, one of the largest structures ever completed in early times and classed by Peruvians among the wonders of the ancient world. Visible from the Plaza de Armas, Cuzco's main square, Sacsahuaman consists of three concentric bastions circling the hilltop. These walls are constructed of cyclopean blocks of a flint-like stone, some of them 25 feet high and 12 feet thick—one is 38 by 18 by 6 feet—all artistically shaped and skilfully fitted together seemingly without the use of a binding material and so accurately it is not possible to slip a knife blade between them. Some of the blocks weigh two tons and since there are none like them in the vicinity, it is assumed they were carried from some miles away. Here as with all Incan masonry, the fitted surfaces were worked by hand. The great walls are built on a zigzag plan, apparently designed to break up any mass assault on the fort.

*C. H. S. Bushnell: *Peru*, 1957. See Reviews, this issue.—Ed.

Sacsahuaman is thought to have been begun in 1438 by the Inca Pachacuti on a spot probably occupied by an earlier fortification — for the Incas did not hesitate to restore fortresses and cities built by previous cultures. How many thousands of hands labored on the fortress; how many years went into its construction; by what power the enormous stones were transported and raised into position — these are questions to ponder.

From a study of the walls at Sacsahuaman it is obvious the keystone principle had no place in Incan architecture. The removal of a stone or several stones from any portion of a wall did not necessarily mean the collapse of that wall. The stones were cut and fitted together with so many angles that each is anchored at several points by the supporting stones to either side and at top and bottom. These stones were cut with 6, 8, or 10 angles or cut surfaces. One wall at Machu Picchu has a stone that has 18 angles. These massive blocks or megaliths were cut in hexagonal, polygonal, rectangular, cellular, quadrangular, curvilinear, and at least ten other geometrical shapes. The only way to destroy a particular wall would be to remove each layer successively. A second virtue of this meshing principle was the immunity it afforded in the event of earthquake, a historic menace in the Lima-Cuzco area. Two major earthquakes have taken their toll of the fine old structures in Cuzco. The first occurred in 1650, the second in 1950. The 1650 disaster wiped out almost the entire city, leaving only the solidly constructed walls of the master builders of the past. In the case of the 1950 tremblor, while modern buildings suffered severe damage or total ruin, Incan structures were only loosened, although there have been instances where a severe shake in the immediate vicinity of certain Incan walls has tumbled them. Another important factor contributing to their durability is that they are "battered," meaning the walls have an upward sloping, backward or inward incline of the outer face. Moreover, all corners are curved in the solid stone, not built plumb by matching up separate stones.

Also standing in Cuzco is all that remains of what once was the finest of Incan edifices, the Temple of the Sun. This most sacred of Incan structures stands in Inti Cancha, the oldest quarter of Cuzco. Legend has it that it was adorned with gold, silver and precious stones. The mechanical and architectural perfection of this example of *circular* stonework is probably without equal in



the world. Today the walls of this Templo del Sol form the foundation for the convent and church of Santo Domingo. The Peruvian government would like to remove the modern structure and restore the temple to its original pagan splendor, an impossible task since no reliable description of the original plan has been found.

Incan structures are by no means confined to Cuzco. In a hundred different places in central Peru are the remains of palaces, fortresses, an ancient reservoir or two, sacred caves, stone carvings, and other Incan relics. In the vicinity of Cuzco are three other major ruin sites named Kenco, Tampomachay, and Puca Pucara. All three can be visited in a half day's tour from Cuzco. Kenco displays in a strikingly vivid way the Incan art of curving corners.

In order to protect the capital city from the raiding tribes of the upper Amazon jungle (a historic justification offered by all warlike peoples for their aggressions) the Incas built a chain of forts, towns, and signal towers throughout the Urubamba Valley. Radiating from Cuzco were the roads built to connect these scattered out-

Corn was ground for *chicha* (corn beer) on these circular grindstones at Machu Picchu.
(Author)

posts. Over these cobbled pavements sped the *chasquis*, or post runners, carrying messages on knotted strings or hurrying from the coast with seafood for the emperor's table. One of these ancient roads leads to Pisac, a small Indian village situated high above the valley of Cuzco. Short tours take visitors to Pisac for the Sunday morning market, one of the most authentic of all native markets. However, those who confine their visit to Pisac's market place will miss one of the most picturesque of all Incan ruin sites.

On a ridge overlooking Pisac are the remains of a temple city seen by few travelers. Reaching the site requires an hour or more of steady climbing. Easily seen on the hillslopes above Pisac, however, are terraced farms attached to the mountain side like giant swallows' nests. These are constructed of the finest stonework I have seen anywhere in the world. Nowhere else have I seen masonry of comparable quality — and the work covers the entire side of a mountain. Since the excursion to Pisac consumes only a half day, visitors will be well rewarded to devote a whole day to the trip and, after the visit to Pisac, continue through the Urubamba Valley to the fortress of

Ollantaytambo. This unfinished fortification is of a different type of architecture from the others and has a grandeur peculiarly its own. It overlooks the valley of the Urubamba, the Sacred Valley of the Incas. Enclosed by high cliffs, carpeted with wildflowers, and luxuriantly cultivated, the Urubamba Valley was the loveliest landscape I saw in all Peru. The hamlet called Urubamba has a first class inn serving meals as good as any I had anywhere in South America.

Most famed of the shrines of Inca land is that named Machu Picchu, a sacred city perched on rocky crags high above the canyon of the Urubamba River. Machu Picchu is a stunning sight. Here is an entire city intact but deserted. Beyond the inn which the government maintains for the convenience of visitors, stretches a complex of temples, courtyards, plazas, stone stairways, terraced farmsites, and roofless houses. The most imposing structures are those named the Convent of the Inca Virgins of the Sun, and the Palace. Machu Picchu, which in its day numbered 1,500 inhabitants, had a system of aqueducts and stone troughs which supplied the holy city with water. A spring at the highest level sent water cascading

➤ Food crops, such as maize, were grown on lofty stone-girt terraces at Machu Picchu.

◀ A heavy-laden descendant of the Incas climbs a staircase street of long-deserted Machu Picchu. (Author's photograph)



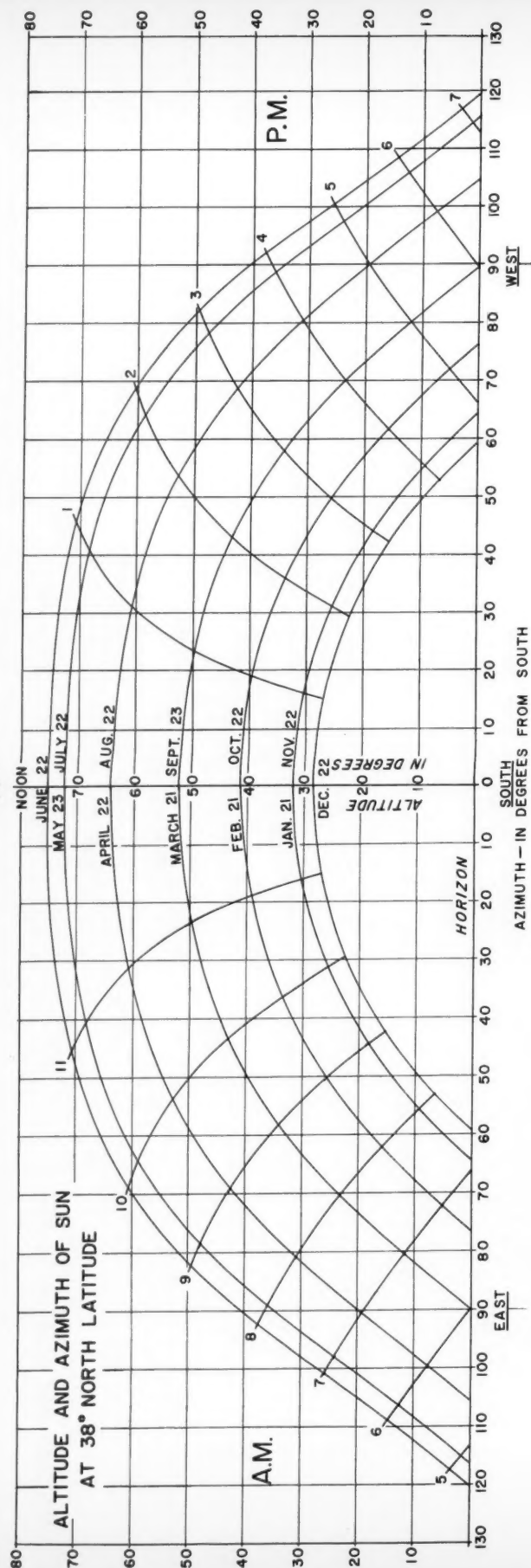
PACIFIC DISCOVERY



down the hillside through a series of alternating stone flumes and stone catch basins so that every home was supplied with water.

It is lucky for posterity that Incan architects built in stone. Although they also built of adobe, these lowland structures have for the most part weathered away. In the environs of Lima, two hours flight to the west of Cuzco, one may see the remains of once large Incaic and pre-Incaic communities constructed entirely of adobe. Foremost among these are Pachacamac, sacred Inca city laid out on a sandy plain; and Cajamarquilla, a site once so populous it has been described as "one of the largest cities of the world when it was built."

Pachacamac and Cajamarquilla were built entirely of adobe molded in tremendous rectangular blocks. The two cities have weathered badly and in time will erode down to the ground. Machu Picchu on the other hand is a completely integrated community of granite which gives every indication of standing for all time; and so with Sacsahuaman, with its towering walls of megalithic blocks; and the walls of Cuzco; the foundation of the Temple of the Sun; and the remains of Kenco, Tampomachay, and Puca Pucara. All are anchored so solidly to the earth one wonders if those powerful Incan emperors had intimations that in building in stone they were building for eternity.



SKY DIARY

July, August, 1958

(Pacific DAYLIGHT SAVING Time used throughout)

Phases of the Moon

☾ Last Quarter	July 8	5:21 P.M.
☾ New Moon	16	11:33 A.M.
☾ First Quarter	23	7:19 A.M.
☾ Full Moon	30	9:47 A.M.
☾ Last Quarter	August 7	10:49 A.M.
☾ New Moon	14	8:33 P.M.
☾ First Quarter	21	12:45 P.M.
☾ Full Moon	28	10:53 P.M.

Meteor Shower

August 11-12—**The Perseids**: maximum 50 per hour that night. Observable a week before and after this date. Best: after midnight.

The Planets

Mercury: Mag. (+0.6). Visible low in the western sky shortly after sunset during the middle of July. Reaches greatest elongation east on July 26 when it will be about one degree south of the star Regulus and about one-third as bright. Inferior conjunction on August 23.

Venus: Mag. (−3.3). Visible in the early dawn above the north-eastern horizon. On July 4 it is three degrees north of Aldebaran.

Mars: Mag. (0.0) Passing through Pisces, Cetus, and Aries. In quadrature (90° west of the sun) on July 26 when it will be rising about midnight.

Jupiter: Mag. (−1.5) North of Spica. In quadrature (90° east of the sun) on July 15, setting a little after midnight on that date. The First Quarter moon passes 1½ degrees south of Jupiter on July 22 at 8:43 P.M.

Saturn: Mag. (+0.5). North of the tail of Scorpius and visible throughout the night in early July. Ends its retrograde motion on August 23 when it sets about midnight.

CHARTING THE SUN

FROM time to time, we at the Morrison Planetarium receive inquiries from photographers, architects, and home builders as to the direction of the sun at a particular hour and date. It is possible, given the latitude, hour, and date, to determine the sun's position in the sky. The solution is a straightforward problem in spherical trigonometry. To answer a majority of these requests a chart indicating the sun's position throughout any year as seen from the latitude of San Francisco is herein reproduced.

The position of the sun is given by the chart in terms of **altitude** (height in degrees above the horizon) and **azimuth** (distance along the horizon in degrees from the south-point). Generally the azimuth is measured by navigators from the north-point, but for our purposes it is more convenient to measure east and west from the south-point.

The curved lines across the chart represent the sun's diurnal arcs or daily paths across the sky on the dates marked. It will be noted that all but two of the diurnal arcs represent the sun's path for two dates (i.e., the sun traces out the same path on August 22 as it does on April 22). Other dates may be interpolated. For instance, the sun's path for September 7 would lie along an arc half-way between the lines marked August 22 and September 23. The morning hours are indi-

PACIFIC DISCOVERY

cated in the left section of the chart, and the afternoon hours in the right section. A time other than indicated may also be interpolated; 4:20 P.M. would lie $\frac{1}{3}$ of the distance between the 4 P.M. and 5 P.M. lines.

After selecting the position on the chart corresponding to the time and date, one merely reads off the correct azimuth and altitude by following the direction of the grid lines. *Example:* the azimuth and altitude of the sun on August 22 at 5 P.M. would be 90° west and 19° high respectively.

The vertical line rising from the south point is the **local meridian** (meaning *middle of the day*). The sun is on the meridian at local apparent noon each day. The earth's axis is not perpendicular to the plane of its orbit but is inclined at $23\frac{1}{2}^\circ$. Thus the sun is high on the meridian at noon in the summer and low in the winter. At the winter solstice (December 22) the sun is $23\frac{1}{2}^\circ$ south of the celestial equator. At the summer solstice (June 22), on the other hand, the sun is $23\frac{1}{2}^\circ$ north of the equator. This fact is evident on the chart by noting that the noon position of the sun on December 22 and June 22 lies equi-distant from the celestial equator (sun's diurnal arc for March 21 and September 23).

The chart is strictly correct only when **apparent solar time** is used; this is the time indicated by sundials. Nevertheless, for most purposes, the chart can be used by assuming that the times indicated represent ordinary standard time. For greater accuracy, however, we must change the time indicated by our

P.S.T. on September 23 for San Francisco (latitude 38° N.):

	3:45 P.M.	P.S.T.
Step 1	- 10	longitude correction for S.F.
	3:35 P.M.	local mean time
Step 2	+ 7	equation of time (interpolated from table)
	3:42 P.M.	local apparent time

Looking at the chart we find for this date and time: Sun's altitude: 26° ; Sun's azimuth: $67\frac{1}{2}^\circ$ west of south. C.F.H.

¹ The interval of time between successive passages of the apparent sun (the sun that *appears* in the sky) across the meridian is not the same from day to day. This is because of the inclination of the earth's axis and the eccentricity of the earth's orbit. In keeping time it is desirable to have a sun that crosses the meridian in equal time intervals. Consequently a fictitious sun has been invented which is so contrived that it crosses the meridian every 24 hours. We regulate our clocks to this fictitious sun which is customarily called the **mean sun** because it represents a mean or averaging of the motions of the apparent or real sun in the sky. The time we measure with respect to the mean sun is **Mean Solar Time**.

² The terms local mean time and local mean solar time are used interchangeably.

³ The **equation of time** is the number of minutes difference between apparent solar time and mean solar time.

THE SUN'S DAILY PATH ACROSS THE SKY



clocks (standard time) to apparent solar time. This involves two simple steps: first, a **longitude correction** to convert standard time into local mean time, and secondly, the **equation of time** correction to change the local mean time into local apparent time which is the time on the chart.

Pacific Standard Time is, by definition, the **local mean time**¹ of the 120th meridian. Therefore if you are located east or west of this standard meridian a correction must be applied. The correction is four minutes for each degree of longitude difference between your meridian and the 120th meridian, added to the standard time if you are east of the meridian or subtracted if you are west. For example, the longitude of San Francisco is $122\frac{1}{2}^\circ$ W. The longitude difference from the standard meridian is $2\frac{1}{2}^\circ$. Multiplying $2\frac{1}{2}$ by four minutes we obtain ten minutes as the correction that must be **subtracted** from the Pacific Standard Time to obtain local Mean Solar Time.²

Next, local mean time is changed into apparent solar time by using the corrections listed in Table 1. This correction, called the **equation of time**,³ varies with the date. When the correction is plus, add it to your local mean time; when the correction is minus, subtract it. Here is an example of the above two steps: find the altitude and azimuth of the sun for 3:45 P.M.,

TABLE I
Equation of Time (in minutes)

Month	First	Tenth	Twentieth	Thirtieth
January	- 3	- 7	-11	-13
February	-14	-14	-14
March	-13	-11	- 8	- 5
April	- 4	- 2	+ 1	+ 3
May	+ 3	+ 4	+ 4	+ 3
June	+ 2	+ 1	- 1	- 3
July	- 4	- 5	- 6	- 6
August	- 6	- 5	- 4	- 1
September	0	+ 3	+ 6	+10
October	+10	+13	+15	+16
November	+16	+16	+15	+12
December	+11	+ 8	+ 3	+ 2



South on floating wheels

20,000 Miles South: A Pan American Adventure. By Helen and Frank Schreider. Doubleday & Company, Inc., Garden City, New York. 1957. 287 pp., 73 photos, numerous drawings, endpaper map. \$3.95.

The spate of true travel books by young adventurers tends to jaundice the reviewer, however enthusiastic for the sort of thing he may be. This one, praise be, is a cure! Let the bookstore browser pass from the uninspired title on the unimaginative jacket down to the blurb: "A Pan American adventure in a seagoing jeep from the Arctic Circle to *Tierra del Fuego*" (italics ours). Even after we allow—having read the book—for a bit of publisher's poetic license (the Schreiders tell quite plainly of driving a station wagon from Circle, Alaska, to the San Diego area, where Frank rebuilt *La Tortuga* the surplus amphibious jeep), we can still feel the impact of such words as "seagoing jeep," "Arctic Circle," and "*Tierra del Fuego*"—words loaded with connotations of hazardous transport and ends-of-the-earth destinations.

Here then is a true adventure book to recommend unreservedly. The challenge: "No one has ever driven the full length of the Americas under his own power." The takers: a young couple—he 30, she 28—who had no use for the practical warning that it couldn't be done, the Pan American Highway still being kept disjointed by mountains and—salt water. The fact that they did it is quite amazing. How they did it makes, in Frank's modest style as first-person narrator, a story of odds overcome to rank with the best. But there is more to it. A good feeling comes to the reader that, with their unconsciously revealed qualities of mind and character, these two came back with much more than the satisfaction of a superb physical achievement: they absorbed a great deal from the places they visited, and returned enriched by experiences and friendships which are good to have early in life, and good to share with others, as they have warmly and heartily through their book.

American art



before Columbus

The Eagle, the Jaguar, and the Serpent: Indian Art of the Americas—North America: Alaska, Canada, the United States. By Miguel Covarrubias. Alfred A. Knopf, New York. 1954. xviii + 314 + xi (Index) pp., 12 pages in full color, 112 line drawings, 100 photos. \$15.00.

Indian Art of Mexico and Central America. By Miguel Covarrubias. Alfred A. Knopf, New York. 1957. xvi + 360 + xvii (Index) pp., 12 pages in full color, 149 line drawings, 64 plates of photographs. \$17.50.

Although we reviewed the first volume of this intended trilogy in the March-April 1955 issue, it must be mentioned again, in prelude to a review of *Indian Art of Mexico and Central America*, first because of certain basic chapters. These are "Origins of the American Indians," "The Basic Horizons for the History of Indian Art," and "The Techniques and Aesthetics of American Indian Art"—120 pages of background not repeated in the present volume. In addition, two other chapters are of interest in reference to two articles in this issue: "The Arctic," which of course deals

with Eskimo culture; and "The Far West," which is largely about California Indians.

The third volume, on South America, may—if it is ever to be written—wait a long time for an author to appear who can match the rare artist-scholar talents of Miguel Covarrubias. One must grieve for the unwritten book while mourning the premature loss of the author of *Mexico South, Island of Bali*, and the two books of Indian Art, the last of which Covarrubias did not live to see published.

With both volumes in hand, it is impossible not to repeat, before considering the last by itself, the gist of previous remarks on the outstanding quality of design and production that Covarrubias' publisher has put into his books. The beauty of typography and the excellence of printing and binding are fitting tribute to the artistry of Miguel Covarrubias himself.

The world of Pre-Columbian Indian Art of Mexico and Central America is one of mystifying complexity whose charting gives us such names as Zacatenco, Ticomán, "Olmec," Toltec, Aztec, Mixtec, Teotihuacán, Monte Albán, Maya—ethnographic and geographic tags for principal cultures, together with a bewildering array of classificatory labels for subdivisions, offshoots, transitions, and intergradations. Such devices are indispensable to a scholarly definition and presentation of the subject; they are "place-names" on the chart of a history, identifiers and handles. They are not, however, to deter the interested lay reader from contemplating and indeed happily losing himself in the richly fascinating fabric here so expertly woven on the loom of history and prehistory. The scholar Covarrubias is for other scholars to debate with (and they do), to agree or disagree with, on matters of origin, direction, and conclusion not yet fully revealed by archeological discovery and typological analysis. The artist Covarrubias speaks to every man, in the spirit of the dictum that "the artist is not a special kind of man, but every man is a special kind of artist." So let us who are not specialists in this or that esoteric approach to his subject simply revel with the deeply and broadly human Covarrubias in the astonishing variety, craftsmanship, design, eloquence, vigorous involvement in the business of living, and insight into human values—in turn somber, gay, cruel, playful, or mystical—which he has revealed through his textual descriptions and displayed in his vivid and meticulous line and color abetted by the splendid album of photographs.

Having viewed it this way, we may yet hold on to a few interesting facts which help to link things together, and associate some names with the things we have seen. It is worth knowing, for instance, that early art in the area discussed—Mexico, Guatemala, El Salvador, Honduras—"seems to have no roots, no origins," no formative stages having yet been discovered; that the swamps and jungles of the southern Gulf of Mexico coast have yielded "mysterious and exciting sculptures" which are "among the masterpieces of world art" but nothing to identify their creators, called "Olmec" for lack of a true name; that the vast "city" of Teotihuacán was "a long-forgotten ruin at the time of the Aztecs"; that the Mixtecs excelled in carving small objects of hard stone and were "the master silversmiths," besides producing the nearest thing to a written history—one could go on with examples, but the pleasure of discovery should be left to the reader of this fascinating and truly great book.

We are indebted to Paul Westheim of Mexico City for a copy of his *La Escultura del México Antiguo* (Universidad Nacional Autónoma de México: Dirección General de Publicaciones, México, 1956; 124 pp., 91 halftone, 3 duotone figs.). A small English edition has been issued, a note in the back says; but if you read Spanish this is not

The figures from
Indian Art of Mexico
and Central America
courtesy of
Alfred A. Knopf,
New York.



difficult, and highly rewarding for its explanation of the motives and modes of Mexico's pre-Cortesian sculpture and architecture. Dr. Westheim makes it clear why the older approaches to classic Greek and Roman art do not lead to the understanding of these New World products whose significance is to be found in all-encompassing religious beliefs. This is good collateral reading along with Covarrubias.

Peru. By G. H. S. Bushnell. Frederick A. Praeger, New York. 1957. 207 pp., 71 photographs, 11 line drawings, map. \$5.00.

First of a series on "Ancient Peoples and Places," edited by Dr. Glyn Daniel, Dr. Bushnell's *Peru* is for students of the pre-Conquest Indian cultures but sufficiently non-technical for all who are stirred by the romance of the past in this ancient land. The author guides us skilfully through the mists of archeological conjecture shrouding the earliest revealed cultures, takes us over the surer grounds of later periods, and brings us into the documented times of the Conquest and post-Conquest. By examining in detail with him the excavated ruins, the pottery, the textiles, the gold ornaments and other metal work, the implements, and the burials with which successive civilizations have enriched the stony soil of Peru, we gain a vivid picture of human life through several thousand years of unwritten history. Although Dr. Bushnell gives meaning to these things with his expert descriptions—much enhanced, of course, by a large set of fine photographs—it is our good fortune that many of the best examples of them are to be seen in a number of museums. Within the past few years a notable collection of Andean cultural objects toured the United States; the book noted below was published in connection with this event.

Ancient Arts of the Andes. By Wendell C. Bennett, with an Introduction by René d'Harnoncourt. The Museum of Modern Art, New York. 1954. 186 pp., 6 color and 202 halftone plates, 4 maps. \$6.50.

Such a book as this gives scarcely less pleasure to the eye and much more information to the mind than the museum exhibition of the actual objects yielded up by Andean archeological sites. The photographs are to be looked at again and again; the text is the work of one of the most eminent students of the subject.

Another book in this field which can only be mentioned at present writing—we have not been able to see a copy up to press time—is *The Art of Ancient Peru* by Heinrich U. Doering (Frederick A. Praeger, New York, \$12.50). Look for review in a later issue.

A Doubleday Anchor Book—compelling narrative retold from the Inca legends and Spanish chronicles—is *The World of the Inca* by Bertrand Flornoy (Garden City, New York, 1958; viii + 238 pp., illus. with drawings and photographs; paper, \$.95). It restores flesh and blood to ancient bones and makes the Incas human personalities.

Cuzco: Window on Peru. By Miriam Kropp. The Studio Publications, Inc., in association with Thomas Y. Crowell Company, New York and London. 1956. 143 pp., frontis. in color, 59 photos, 3 maps. \$6.00.

A San Franciscan who has known Cuzco intimately for a dozen years, Miriam Kropp (Mrs. Pedro Beltrán) wrote this history-packed guide to the ancient Inca capital to fill the need for one. The brief historical introduction is developed through detailed descriptions of the principal buildings and sites in and around the city, those of Inca, Colonial, and recent periods. There are chapters on Excursions, Fiestas, Practical Information; a brief reading list and an index complete the text. There is an album of excellent and well reproduced photographs.

For young palefaces

Stories California Indians Told. By Anne B. Fisher. Par-nassus Press, Berkeley, California. 1957. 110 pp., illustrated in color by Ruth Robbins. \$2.95.

Around their campfires the California Indians, men, women, and children of the Karok, Shasta, Achomawi, Pomo, Miwok, Mono, Yokuts, Chumash, Gabrielino and other tribes, listened to the stories their medicine men told—stories of the earth, fire, drought and rain, lakes and rivers, the first Indians, the animals and birds. Eagle was brave and beautiful, Coyote was crafty and cunning (just like Fox in some cultures) but always man's friend. It was Coyote who stole fire for men, who through his devotion brought water and fish to Clear Lake, who made a sun to light the world.

In a brief Foreword to this sparkling little book, Professor Adan E. Treganza of San Francisco State College says these twelve tales were told to Mrs. Fisher by that noted anthropologist Dr. C. Hart Herriam who in turn got them directly from the lips of Indian story-tellers. Done with lightness and humor, Ruth Fisher's versions are as fresh as California spring mornings, and quite free of the childish cuteness that would send our eight-year-old sophisticates back to the TV (incidentally, some imaginative producer could do a wonderful cartoon job of these lively and suspenseful plots).

Indian Games and Crafts. By Robert Hofsinde (Gray-Wolf). William Morrow and Company, New York. 1957. 126 pp., 83 figs. in line by the author. \$2.50.

Indian Sign Language. By Robert Hofsinde (Gray-Wolf). William Morrow and Company, New York. 1956. 96 pp., numerous illus. in line by the author. \$2.50.

Danish-born Robert Hofsinde, trained in the Royal Art Academy of Copenhagen, came as a young man to the United States. Trapping in the Minnesota woods, he found a Chippewa Indian boy with a broken leg and saved his life. The grateful Chippewas made him a blood-brother of the tribe and named him Gray-Wolf. Now curator of the Plume Indian Museum in Monroe, New York, Mr. Hofsinde has since that incident devoted himself to studying and writing about Indian culture, particularly handicrafts.

Indian Games and Crafts describes most clearly in words and pictures 14 different games and projects, from Eskimo Buzz Board to Hopi Kachinas. A master craft teacher and camp counselor, "Gray-Wolf" provides hours of fun for Scouts and all other summer campers while helping to keep alive a part of our Indian heritage.

With some 500 entries, *Indian Sign Language* (alphabetized in Index only) is a concise illustrated dictionary of the only continent-wide form of "speech" in America be-

academically speaking

ABOUT A YEAR AGO, a somewhat peculiar-looking truck left the California Academy of Sciences en route to Africa via New Orleans. In the truck were Dr. Edward S. Ross, Curator of Entomology at the Academy, Mrs. Ross, and Robin Leech, son of Hugh B. Leech, Associate Curator of Entomology.

The truck itself was ordinary enough, but on top of the space for equipment and specimens to be collected was attached a vaulted canvas structure which looked like nothing so much as an overgrown covered wagon. Its highly practical purpose was to provide sleeping and cooking space for the members of the expedition while collecting in the field, but the appearance of the structure caused more than one observer to wonder if there would be any specimens left in the field to collect if they once got a clear look at the truck. There were, it turns out.

Just after sailing for the United States, Dr. Ross wrote: "At last we are homeward bound. We should reach San Francisco about July 15. It will be good to have a chance to study our vast collections. I succeeded in getting both State and Federal permission to import living Embioptera [an order of silk-spinning insects which spend a great deal of time running about backward and which order is Dr. Ross's special passion] and have with me about 300 thriving cultures. These will make possible the rearing of thousands of study specimens and open all sorts of possibilities in experimental cross-breeding. [Not another miracle fiber, please.]

"There is so much new material to work over that the



Edward S. Ross's photo shows his wife, Wilda, with Robin Leech, and the "covered wagon" in Africa.

seven remaining months of NSF [National Science Foundation] time will not be enough to do the job. Perhaps I should apply for a 12-month extension. A separate African volume of some 500 pages will be needed and the Congo Museum has offered to publish this in 1959.

"Along with the research, I must squeeze in a heavy lecture and writing schedule based on our rich experiences and many pictures. There will also be the editing of some 10,000 feet of nature film on many subjects—big game,

fore the spread of English. Its history is lost in the past of Great Plains tribesmen—wanderers used it most—but it was a living language, growing to include such innovations as *white man*, *Negro* (*black white man*), *bicycle* (combining *wagon*, *ride*, *sit*, and *go*—an Indian would say "lazy white man sit down and walk," to describe in words a paleface riding one), *motion picture* ("sign owl, and making cranking motion with right hand. Add sign for *COLOR* to indicate *TECHNICOLOR*")—"Gray-Wolf" does not carry his compilation into the atomic age! (These are Morrow Junior Books.)

People of the Snow: Eskimos of Arctic Canada. By Wanda Tolboom. Coward-McCann, Inc., New York. 1956. 96 pp., numerous photos, maps. \$1.95.

Coward's "Challenge Books form a new series of human geography books" for young readers, "written with the accuracy of first-hand reporting and the suspense of high adventure." Although her thread of narrative is exceedingly slender and barely suspenseful, Wanda Tolboom's description of daily Eskimo life is indeed first-hand. She and her fur-trader husband lived two years as the only whites at an isolated post among two hundred of the "Inuit" ("Eskimo" was once a somewhat scornful *Indian* nickname for "the People"). Knowing them intimately gave her the respect that enabled her to tell the story—from what is surmised of their early crossing the Bering Strait from northern Asia, down through the thousands of years to a present in which they have kept their unique way of life essentially intact—of perhaps the most independent people on earth.

The story is simple: this is the Far North, land of ice, snow, the long winter night, permafrost, the long summer sun, treeless tundra. These are the people who live here; this is how they shelter, clothe, feed themselves. These are the diversions and values that make life worth living, even here. Contact with white civilization has brought these changes, these confusions, yet finally this triumph of an ancient wisdom: "They are accepting those things that will improve their way of life and casting aside the others, in

the true Eskimo manner of taking all that is good from the land and ignoring the useless or the harmful. They realize that many of the old, simple ways are best for them after all." There is a lesson here for us—young or old.

People of the Many Islands: Polynesians and Rivers in the Sea. By Bill Brown. Coward-McCann, Inc., New York. 1958. 94 pp., maps and diagrams by Wes McKeown; many photos. \$2.50.

Ocean currents are rivers, following regular paths, just like rivers on land. Winds, too, are regular in their habits—the trade winds of the great oceans. Before the compass, before steam, currents and winds were both power and guidance to navigators of uncharted oceans. For greatest distances traveled, by large numbers, with the least in vessels and navigational aids, the Polynesians are all-time champions. Bill Brown, of Fairfax, California, has sailed a 32-foot schooner from San Francisco to Tahiti, and has lived among Polynesians. In the tradition of the Challenge Books series, he writes first-hand of modern Polynesia, having first given in story form the background of early Polynesia—the Polynesia of the great transpacific migrations and settling of virgin islands—based upon a painstaking study of the best authorities (this statement is first-hand; *PD's* editorial library supplied the books!). It is interesting to speculate whether Bill's picture of the voyages—planned long crossings—may have reflected the New Zealander Andrew Sharp's recently published theory of *accidental* voyages if it had been in his hands (and ours!) when he wrote. While scholars debate such matters, young readers may get from this newest Challenge Book a clear and true picture of the Polynesian way of life, past and present.

(Continued from page 6)

the book itself, which has been designed and printed with taste and care. Altogether, *Landscapes of Alaska* is a handsome tribute to our forty-ninth state, and will help the other forty-eight to know and appreciate her.

reptiles, birds, besides the insects. On my last day ashore, I succeeded in getting what I think are the first shots of the tailor ants matting foliage together with silk spun by larvae held in the jaws of the workers." [Now if the tailor ants can be introduced to the cross-bred Embioptera . . . well, anyway the expedition, co-sponsored by the Academy, the National Geographic Society and friends of the Academy through The San Francisco Foundation, had a busy year.]

JOHN THOMAS HOWELL, the Academy's Curator of Botany, was elected last month an honorary member of the Lay Faculty Club at the University of San Francisco. Both Howell and the Academy felt deeply honored but Howell, with seemingly modesty, paled a bit at the citation which read, in part: . . . "in appreciation and recognition of his eminent attainments, his inspiring leadership in education, his high standards of professional life, and his valuable contribution to Christian scholarship." With all due respect to the University, someone remarked the citation sounded like one Harvard might give to a man who had just signed over a million or two dollars to the school.

Speaking of Howell's attainments, he has just completed, with the aid of Peter Raven and Peter Rubtsoff, his *Flora of San Francisco California*. The list, which contains about 1,000 species, was published last month by USF as reprinted from the *Wasmann Journal of Biology*. It sells for \$3 per copy and is available at the Academy or from the USF bookstore.

Another list Howell has been working on for some time

will comprise the flora of the Sierra Nevada. In furtherance of this project, Howell this month will spend two weeks collecting specimens in that range. Highlight of the trip will be a three-day pack trek to the remote and seldom-visited Tehipite Valley on the middle fork of the King's River. A good friend of the Academy, P. M. Tompkins, is sponsoring the trip.

THE AMERICAN MEDICAL ASSOCIATION convention held last month was one of the largest conclaves San Francisco has ever hosted and it meant lots of extra work for lots of people. Among the very busiest were the members of the Academy's Television Department which produced a series of five television programs, seen over KQED-TV, Channel 9, entitled "AMA Daily Bulletin of the Air."

Co-sponsored by the AMA and the firm of Merck, Sharp and Dohme, the series inaugurated what Ben Draper, Executive Producer in the Television Department, called "an important refinement of television news coverage."

Instead of the usual technique of a reporter interpreting the news, the doctors who were making the news themselves in the AMA sessions appeared on the programs and told their stories.

Full length papers, selected to give as wide as possible coverage of the 21 fields of medicine represented at the AMA convention as well as for their headline news value, were boiled down to completely-scripted four to eight minute presentations. With the addition of visual materials, the series represented one of the most intelligent, thoughtful examples of television news coverage yet produced.

BOOKS BY MAIL

. . . from the Academy

FRONTIER TO SPACE

by Eric Burgess

\$4.75

How modern rockets are enabling man to obtain accurate information on conditions at the frontier to interplanetary space, information he needs before he can attempt space flight. Fully illustrated with photographs and drawings.

CINNABAR, A GAME OF ROCKS AND MINERALS

by Ruth Wheeler and Vinson Brown

\$1.45

Another in the series of popular Nature Games, Rocks and Minerals is not only fun to play, it is a valuable aid in teaching more about this branch of natural history. Included in the game are a 56-card playing deck—each card shows a rock or mineral in full color plus specific information about the rock—and instructions for playing the game.

MAKING YOUR OWN TELESCOPE

by Allyn J. Thompson

\$4.25

Almost every amateur astronomer has an ambition to have his own telescope. This book contains complete and detailed instructions with which the amateur astronomer can make his own telescope, at a fraction of the cost of a commercially manufactured one and as good as instruments of similar size to be found in the observatories of professional astronomers. Fully illustrated.

All prices as shown above include tax and postage.

Send order and check or money order to:

CALIFORNIA ACADEMY OF SCIENCES
Golden Gate Park, San Francisco 18, California

Correction: In the May-June issue five photos (pages 4-9) were credited to Dr. G. Dallas Hanna, Academy curator of geology; it turns out they were actually taken—during the same air survey of the St. Elias Range—by **Bradford Washburn**, now Director of the Boston Museum of Science. We regret the file snafu and apologize to Dr. Washburn.—Ed.

EASY CHAIR COMFORT

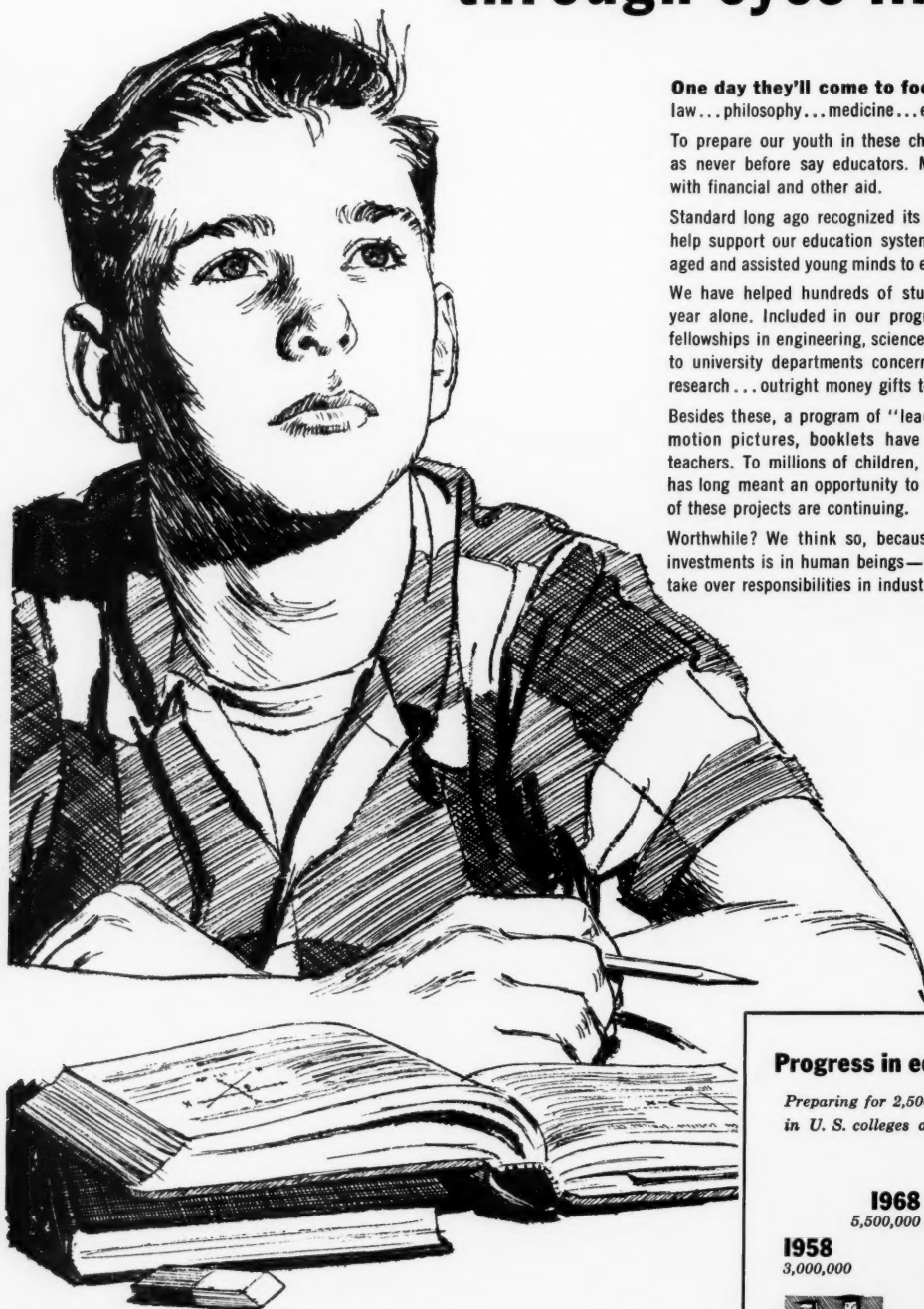


LONG RUGGED WEAR



AMERICA'S FINEST OVERALL
Since 1850

We must look at the space age through eyes like these



One day they'll come to focus on a career—in science... law... philosophy... medicine... engineering... the arts.

To prepare our youth in these challenging times, help is needed as never before say educators. Many companies are responding with financial and other aid.

Standard long ago recognized its obligation as a good citizen to help support our education system and for 20 years has encouraged and assisted young minds to explore the wide field of learning.

We have helped hundreds of students attend college, 241 this year alone. Included in our program are scholarships, graduate fellowships in engineering, science and business plus financial aid to university departments concerned... broad projects in basic research... outright money gifts to schools.

Besides these, a program of "learn by doing" kits, film strips, motion pictures, booklets have been used and acclaimed by teachers. To millions of children, the Standard School Broadcast has long meant an opportunity to hear and enjoy good music. All of these projects are continuing.

Worthwhile? We think so, because one of the most productive investments is in human beings—those who in time to come will take over responsibilities in industry and in our nation.

Progress in education means...

*Preparing for 2,500,000 additional students
in U. S. colleges and universities by 1968.*

1968
5,500,000

1958
3,000,000



STANDARD OIL COMPANY OF CALIFORNIA

plans ahead to serve you better

